MITSUBISHI SEMICONDUCTORS 1993

RF POWER SEMICONDUCTORS

DATA BOOK

MITSUBISHI ELECTRIC

HIGH FREQUENCY HIGH POWER TRANSISTORS

2SC730

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC730 is a silicon NPN epitaxial planar type transistor designed for industrial use RF power amplifiers on VHF band mobile radio applications.

FEATURES

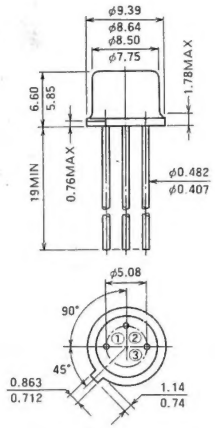
- High power gain: $G_{pe} \geqq 10dB$
  @V_{CC} = 13.5V, P_O = 1W, f = 150MHz
- TO-39 metal seeled package for high reliability.
- All electrodes are isolated from the case.

APPLICATION

0.5 to 0.8 watt power amplifiers, and driver stage in VHF band.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CER}	Collector to emitter voltage	R_{BE}=10Ω	40	V
I_C	Collector current		0.4	A
P_C	Collector dissipation	T_a=25°C	1.03	W
		T_C=25°C	3	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65∼+175	°C
Rth-a	Thermal resistance	Junction to ambient	145	°C/W
Rth-c		Junction to case	50	°C/W

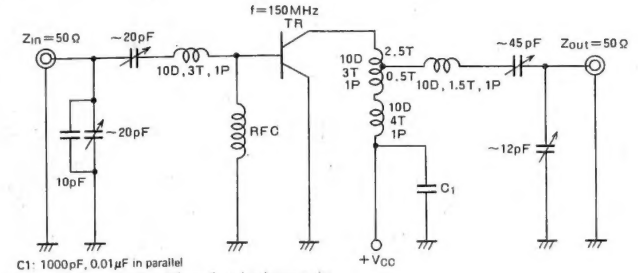
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=10Ω	40			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			10	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2.5V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.1W, f=150MHz	1	1.5		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

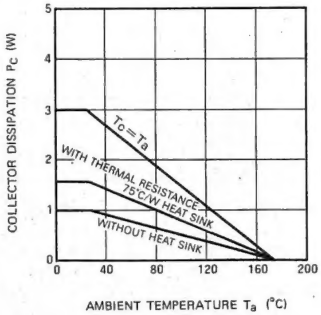


C1: 1000pF, 0.01μF in parallel

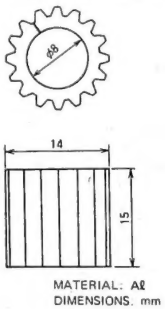
Notes: All coils are made from 1.5mm silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE

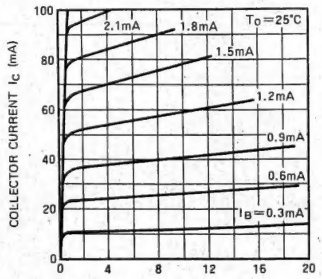


THERMAL RESISTANCE 75°C HEAT SINK DRAWING

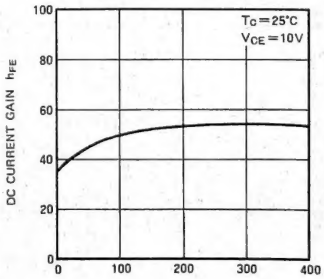


MATERIAL: Aℓ
DIMENSIONS. mm

OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT



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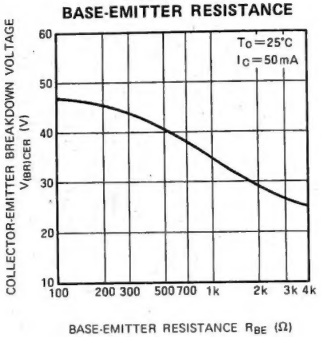
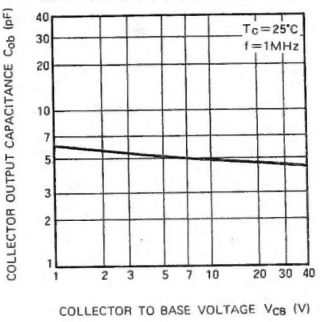
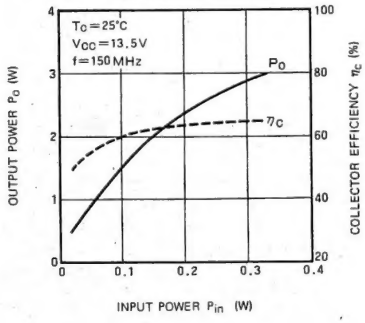
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



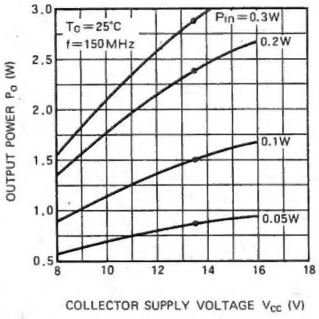
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC741

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC741 is a silicon NPN epitaxial planar type transistor designed for industrial use RF power amplifiers on VHF band mobile radio applications.

FEATURES

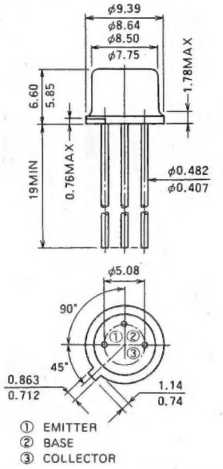
- High power gain: $G_{pe} \geqq 13$dB
  @V_{CC} = 13.5V, P_o = 0.2W, f = 150MHz
- TO-39 metal seeled package for high reliability.
- Collector electrode is electrically connected to the case.

APPLICATION

Driver stage in VHF band.

OUTLINE DRAWING

Dimensions in mm



NOTE T-8C. COLLECTOR ELECTRODE IS CONNECTED WITH CASE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CER}	Collector to emitter voltage	R_{BE}=10Ω	40	V
I_C	Collector current		0.3	A
P_C	Collector dissipation	T_a=25°C	0.68	W
		T_C=25°C	2.5	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65～+175	°C
Rth-a	Thermal resistance	Junction to ambient	220	°C/W
Rth-c		Junction to case	60	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=10Ω	40			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			1	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=10mW, f=150MHz	0.2	0.3		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

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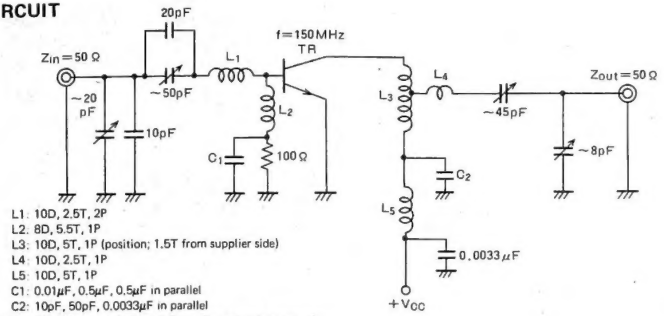
NPN EPITAXIAL PLANAR TYPE

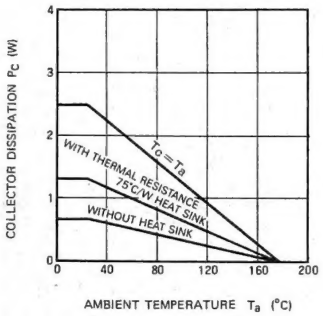
TEST CIRCUIT



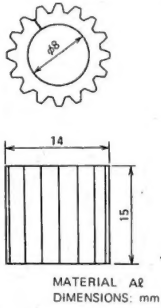
L1: 10D, 2.5T, 2P
L2: 8D, 5.5T, 1P
L3: 10D, 5T, 1P (position; 1.5T from supplier side)
L4: 10D, 2.5T, 1P
L5: 10D, 5T, 1P
C1: 0.01μF, 0.5μF, 0.5μF in parallel
C2: 10pF, 50pF, 0.0033μF in parallel
Notes: All coils are made from 1.5mm silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

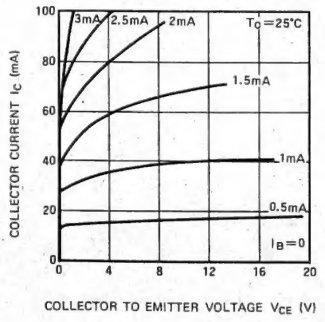
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



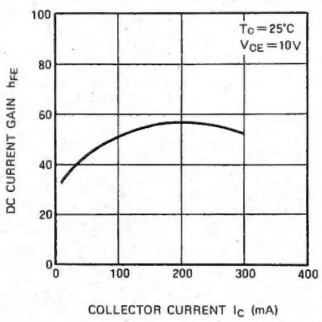
THERMAL RESISTANCE 75°C HEAT SINK DRAWING



OUTPUT CHARACTERISTICS, COMMON EMITTER

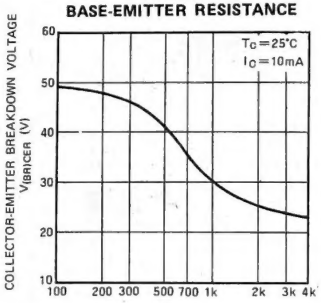


DC CURRENT GAIN VS. COLLECTOR CURRENT

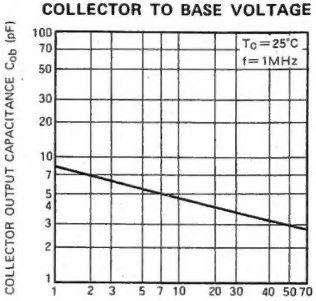


NPN EPITAXIAL PLANAR TYPE

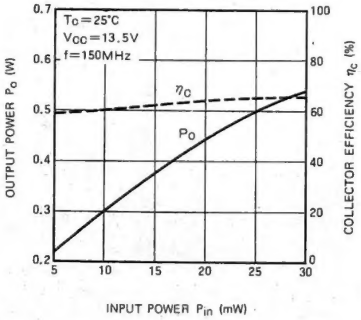
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



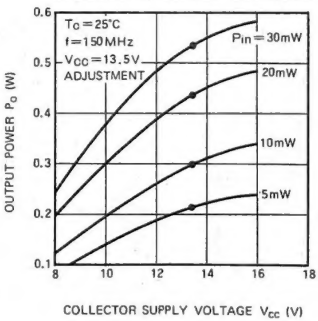
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



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2SC908

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC908 is a silicon NPN epitaxial planar type transistor designed for industrial use RF power amplifiers on UHF band mobile radio applications.

FEATURES

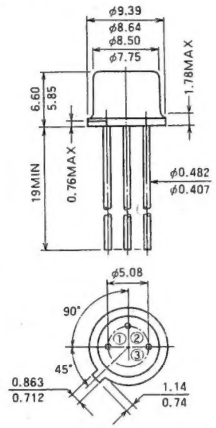
- High power gain: $G_{pe} \geqq 4dB$
  @V_{CC} = 13.5V, P_O = 1W, f = 500MHz
- TO-39 metal seeled package for high reliability.
- All electrodes are isolated from the case.

APPLICATION

0.5 to 0.8 watt power amplifiers, and driver stage in UHF band.

OUTLINE DRAWING

Dimensions in mm



① EMITTER
② BASE
③ COLLECTOR

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CER}	Collector to emitter voltage	R_{BE}=10Ω	40	V
I_C	Collector current		0.5	A
P_C	Collector dissipation	T_a=25°C	0.86	W
		T_C=25°C	4.3	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65～+175	°C
Rth-a	Thermal resistance	Junction to ambient	175	°C/W
Rth-c		Junction to case	35	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_O=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	40			V
$V_{(BR)CER}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=10Ω	40			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			50	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			100	μA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.4W, f=500MHz	1	1.2		W
η_C	Collector efficiency		50	70		%

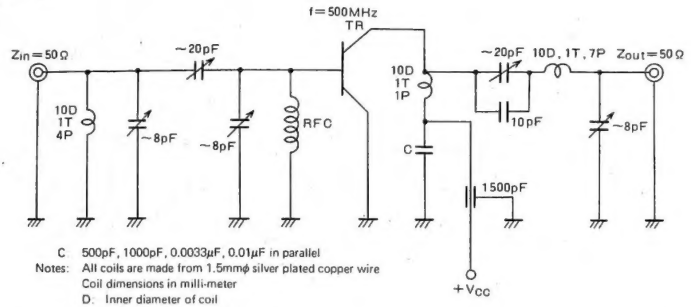
* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

2SC908

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

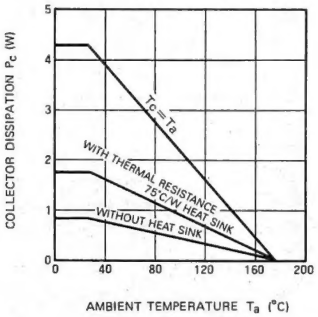


C 500pF, 1000pF, 0.0033μF, 0.01μF in parallel

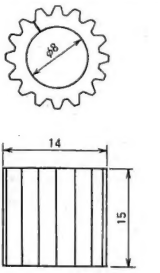
Notes: All coils are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE

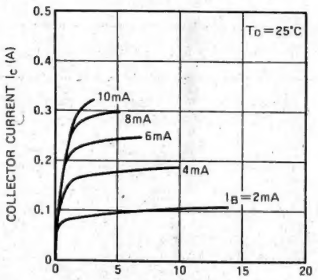


THERMAL RESISTANCE 75°C HEAT SINK DRAWING

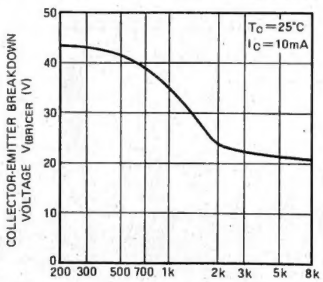


MATERIAL Aℓ
DIMENSIONS: mm

OUTPUT CHARACTERISTICS, COMMON EMITTER



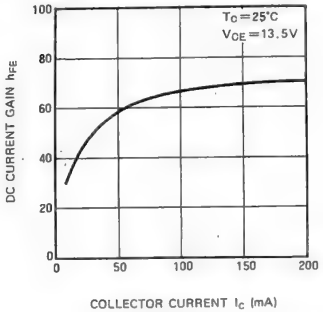
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



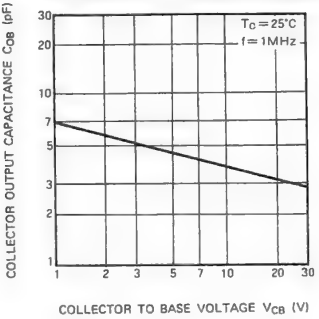
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

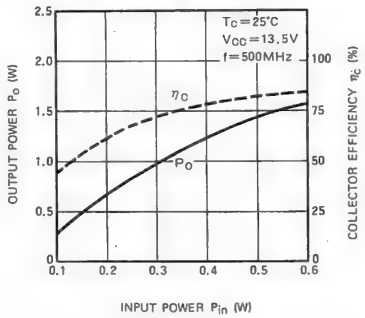
DC CURRENT GAIN VS. COLLECTOR CURRENT



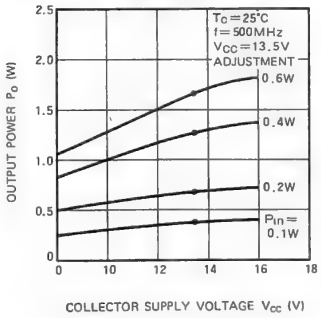
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



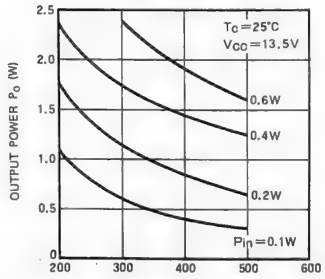
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



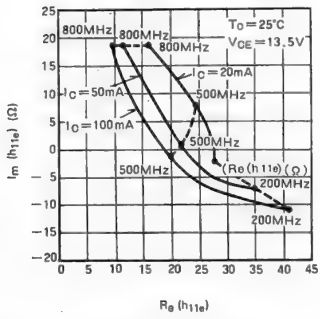
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. FREQUENCY

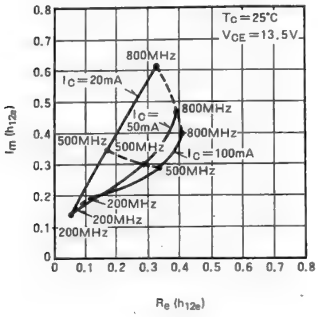


h11e – FREQUENCY

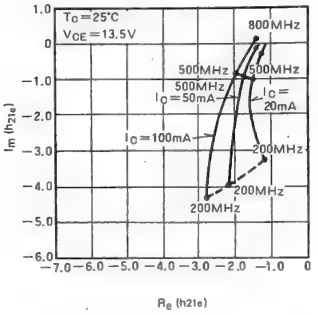


NPN EPITAXIAL PLANAR TYPE

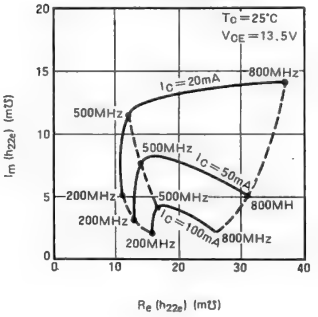
h_{12e} – FREQUENCY



h_{21e} – FREQUENCY



h_{22e} – FREQUENCY



MITSUBISHI ELECTRIC

2SC1324

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1324 is a silicon NPN epitaxial planar type transistor designed for industrial use RF broadband amplifiers from VHF to UHF band.

FEATURES

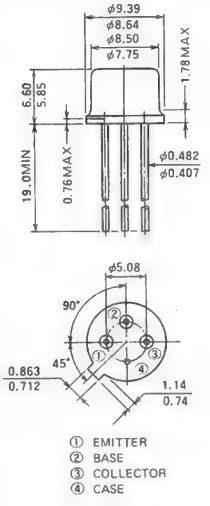
- High power gain: $G_{pe} \geqq 9dB$
  @V_{CC} = 15V, I_C = 30mA, f = 770MHz
- TO-12 metal seeled package with case grounded pin for high reliability and good performances.
- All electrodes excepted ground pin are isolated from the case.

APPLICATION

Broadband amplifiers from VHF to UHF band.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	25	V
I_C	Collector current		150	mA
P_C	Collector dissipation	T_a=25°C	0.8	W
		T_C=25°C	3	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−65 ~ +175	°C
Rth-a	Thermal resistance	Junction to ambient	187.5	°C/W
Rth-c		Junction to case	50	°C/W

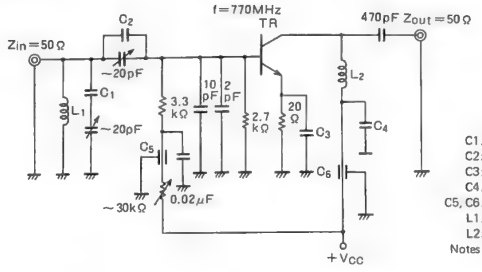
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=∞	25			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			50	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			75	μA
h_{FE}	DC forward current gain *	V_{CE}=15V, I_C=30mA	20	70	180	—
Gpe	Power gain	V_{CC}=15V, f=770MHz, I_C=30mA	9	10		dB
f_T	Transition frequency	V_{CE}=15V, I_C=30mA		1.7		GHz
NF	Noise figure	V_{CC}=15V, I_C=30mA, f=500MHz, R_G=50Ω		5		dB

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

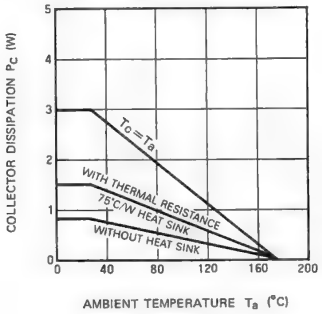
TEST CIRCUIT



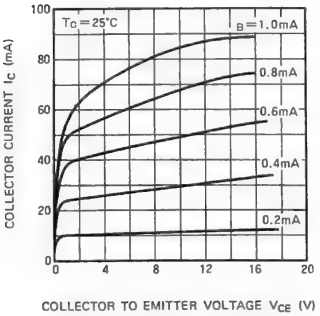
C1. 2pF, 3pF in parallel
C2: 3pF, 4pF in parallel
C3: 500pF, 0.02μF in parallel
C4. 0.05μF, 0.03μF, 0.01μF in parallel
C5, C6. 1500pF
L1. 4mm core, 10T, enameled wire
L2: Width 2mm, length 20mm ribbon lead (silver plated copper plate)
Notes Coil dimensions in milli-meter
T. Turn number of coil

TYPICAL PERFORMANCE DATA

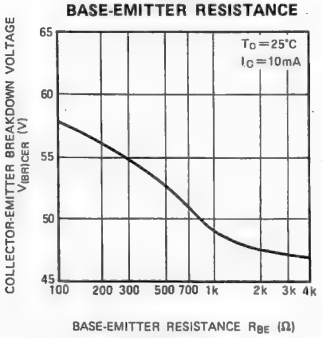
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



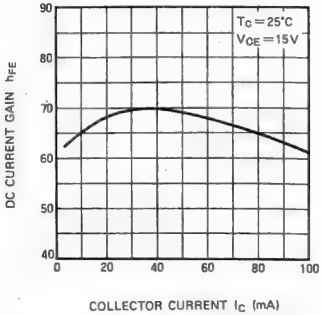
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



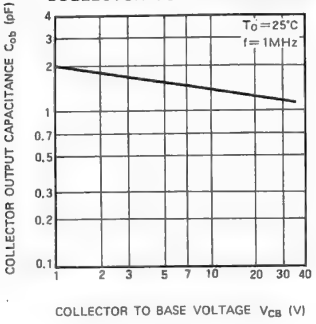
DC CURRENT GAIN VS. COLLECTOR CURRENT



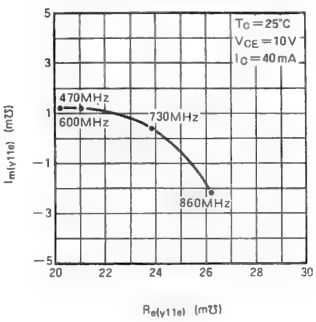
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

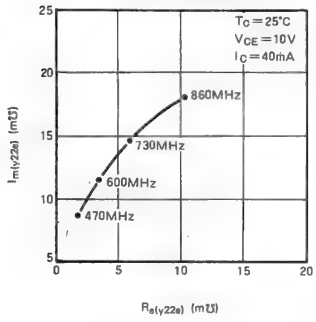
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



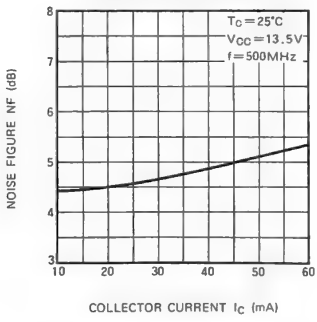
INPUT ADMITANCE VS. FREQUENCY



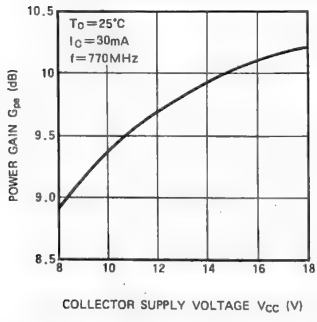
OUTPUT ADMITANCE VS. FREQUENCY



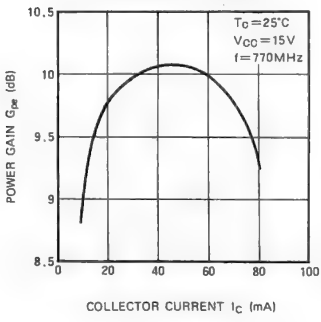
NOISE FIGURE VS. COLLECTOR CURRENT



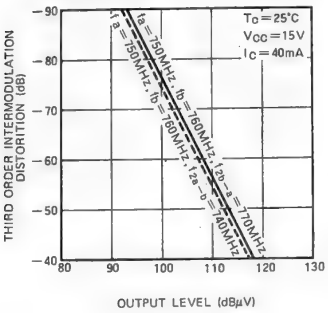
POWER GAIN VS. COLLECTOR SUPPLY VOLTAGE



POWER GAIN VS. COLLECTOR CURRENT



THIRD ORDER INTERMODULATION DISTORTION VS. OUTPUT LEVEL



MITSUBISHI ELECTRIC

2SC1729

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1729 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio amplications.

FEATURES

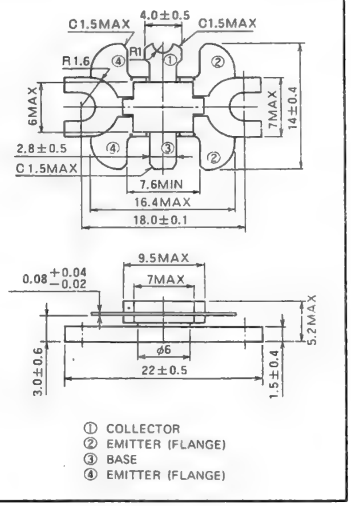
- High power gain: $G_{pe} \geqq 10$dB
  @V_{CC} = 13.5V, P_O = 14W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 and load VSWR when operated at V_{CC} = 15.2V, P_o = 18W, f = 175MHz.

APPLICATION

10 to 14 watts output power amplifiers applications in VHF band.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

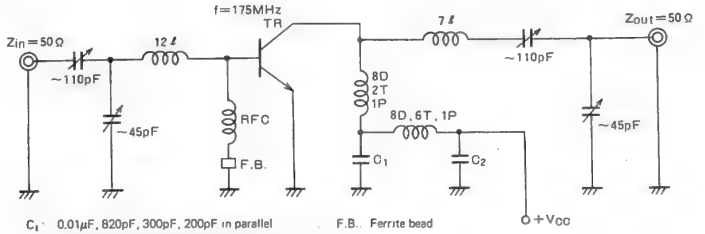
Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		3.5	A
P_C	Collector dissipation	T_a=25°C	2.5	W
		T_C=25°C	35	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65～+175	°C
Rth-a	Thermal resistance	Junction to ambient	60	°C/W
Rth-c		Junction to case	4.3	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			0.5	mA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=1.4W, f=175MHz	14	16		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

TEST CIRCUIT

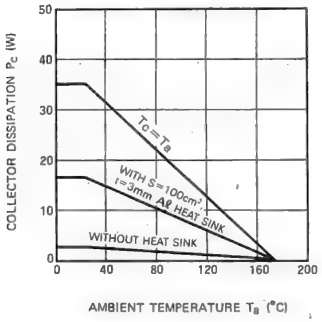


C_1: 0.01μF, 820pF, 300pF, 200pF in parallel
C_2: 22μF, 0.1μF, 0.02μF, 300pF in parallel
F.B.: Ferrite bead

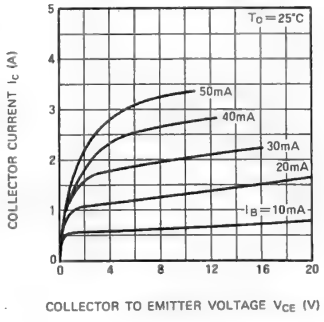
Notes: All coils are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
ℓ: Length

TYPICAL PERFORMANCE DATA

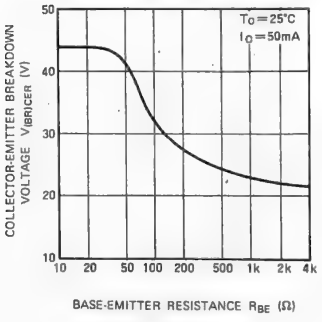
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



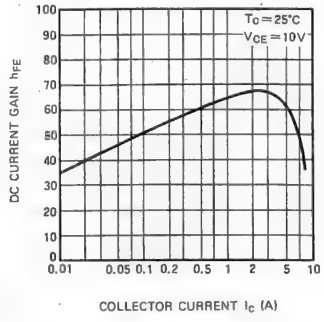
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



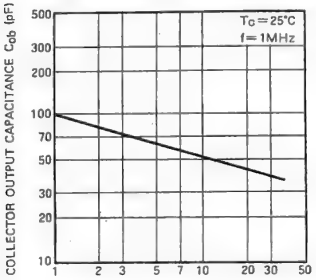
DC CURRENT GAIN VS. COLLECTOR CURRENT



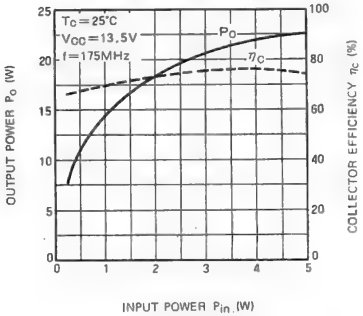
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

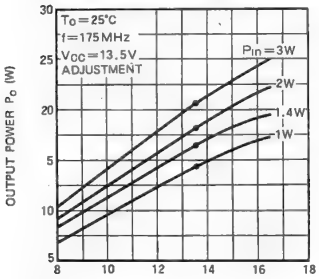
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1945

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1945 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on HF band mobile radio applications.

FEATURES

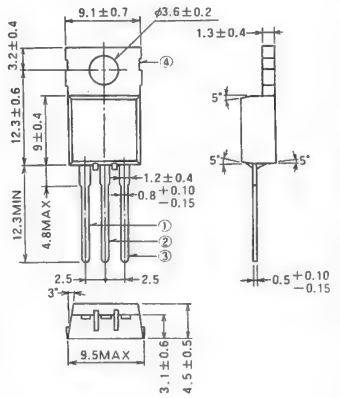
- High power gain: $G_{pe} \geqq 14.5$dB
  @V_{CC} = 12V, P_O = 14W, f = 27MHz
- Emitter ballasted construction for high reliability and good performances.
- TO-220 package similarly is combinient for mounting.
- Ability of withstanding infinite load VSWR when operated at V_{CC} = 16V, P_O = 18W, f = 27MHz.

APPLICATION

10 to 14 watts output power class AB amplifiers applications in HF band.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		80	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	40	V
I_C	Collector current		6	A
P_C	Collector dissipation	Ta=25°C	1.5	W
		T_C=25°C	20	W
T_j	Junction temperature		+150	°C
Tstg	Storage temperature		−55~+150	°C
Rth-a	Thermal resistance	Junction to ambient	83.3	°C/W
Rth-c		Junction to case	6.25	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

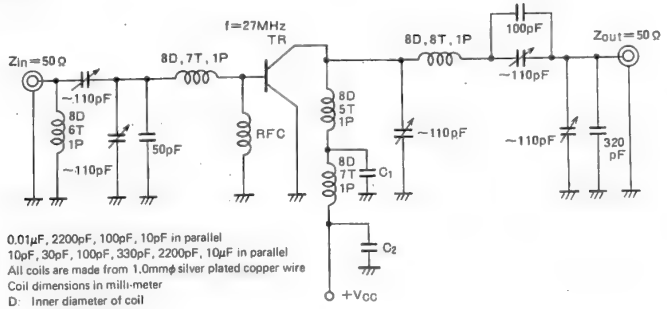
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	80			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=∞	40			V
I_{CBO}	Collector cutoff current	V_{CB}=30V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=4V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=12V, Pin=0.5W, f=27MHz	14	16		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

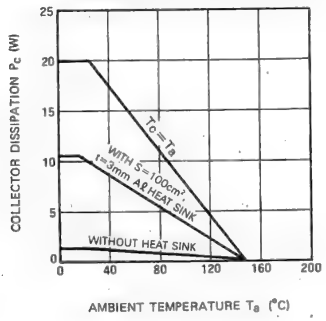
TEST CIRCUIT



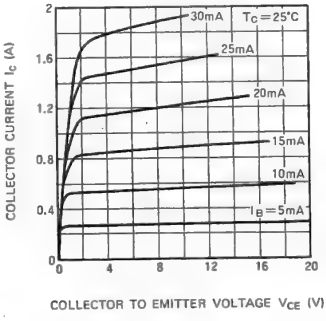
C_1: 0.01μF, 2200pF, 100pF, 10pF in parallel
C_2: 10pF, 30pF, 100pF, 330pF, 2200pF, 10μF in parallel
Notes: All coils are made from 1.0mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

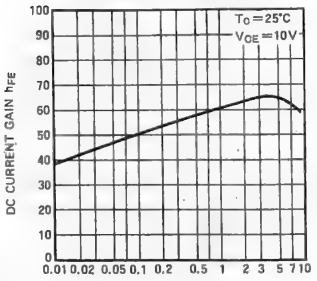
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



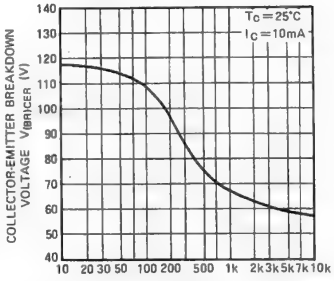
OUTPUT CHARACTERISTICS, COMMON EMITTER



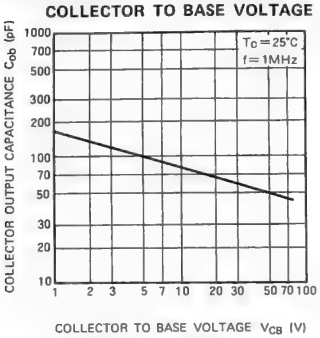
DC CURRENT GAIN VS. COLLECTOR CURRENT



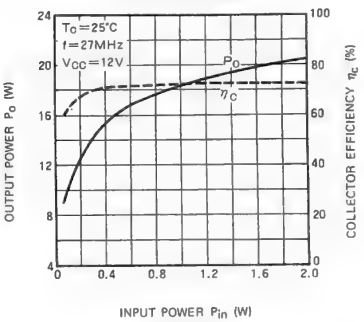
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



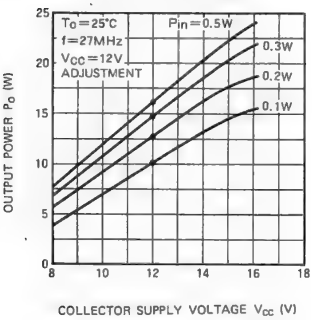
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC1946

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC1946 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio applications.

FEATURES

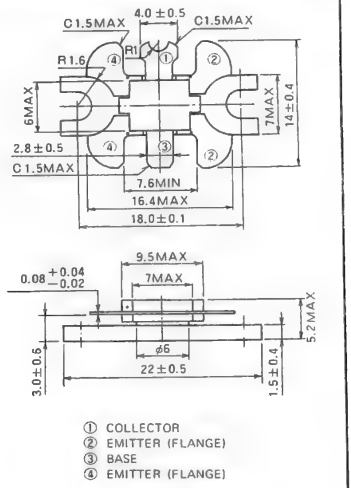
- High power gain: $G_{pe} \geqq 6.7$dB
  @V_{CC} = 13.5V, P_O = 28W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 30W, f = 175MHz.

APPLICATION

25 watts output power amplifiers applications in VHF band.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	17	V
I_C	Collector current		7	A
P_C	Collector dissipation	T_a=25°C	3	W
		T_C=25°C	50	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−65~+175	°C
R_{th-a}	Thermal resistance	Junction to ambient	50	°C/W
R_{th-c}		Junction to case	3	°C/W

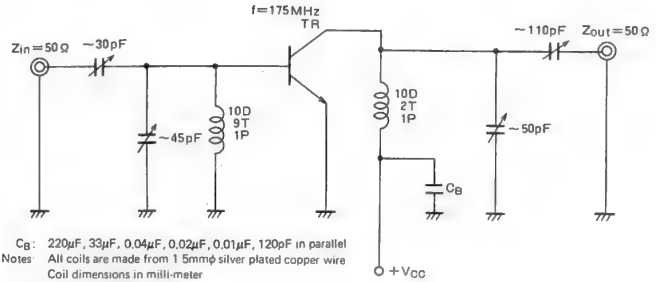
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=100mA, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1	mA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.2A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=6W, f=175MHz	28	32		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

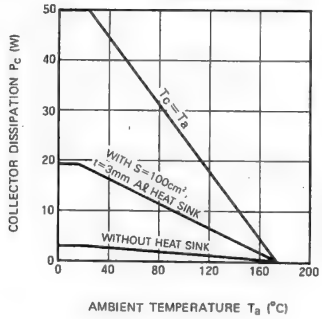


C_B: 220μF, 33μF, 0.04μF, 0.02μF, 0.01μF, 120pF in parallel

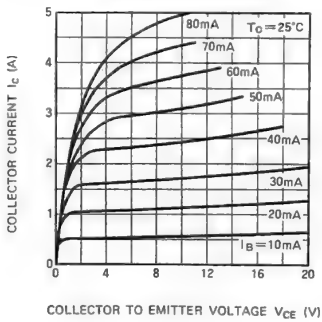
Notes: All coils are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

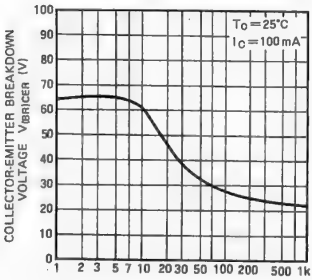
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



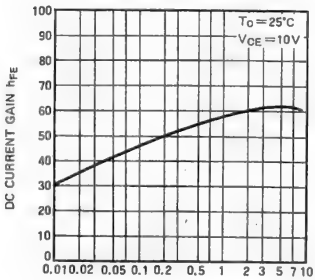
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



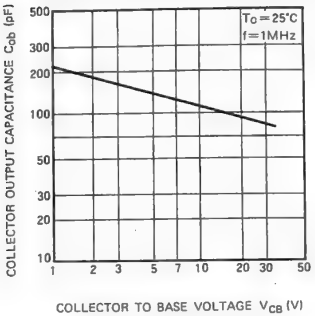
DC CURRENT GAIN VS. COLLECTOR CURRENT



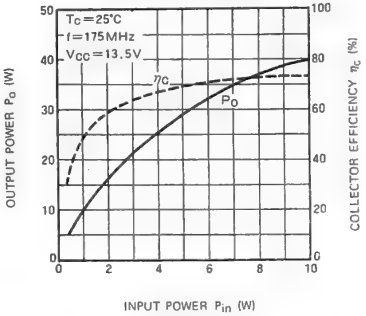
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

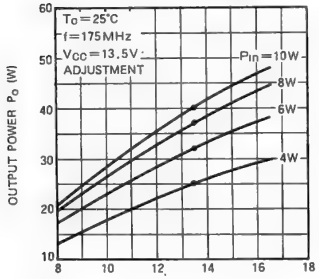
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1946A

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1946A is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio applications.

FEATURES

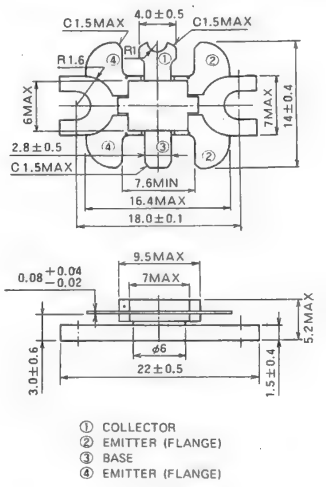
- High power gain: $G_{pe} \geqq 10$dB
  @V_{CC} = 13.5V, P_O = 30W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 30W, f = 175MHz.
- Equivalent input/output impedance at rated operating conditions: $Z_{in} = 0.65 + j1.4\Omega$
  $Z_{out} = 1.9 + j0.75\Omega$

APPLICATION

25 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		7	A
P_C	Collector dissipation	T_a=25°C	3	W
		T_C=25°C	50	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	3	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

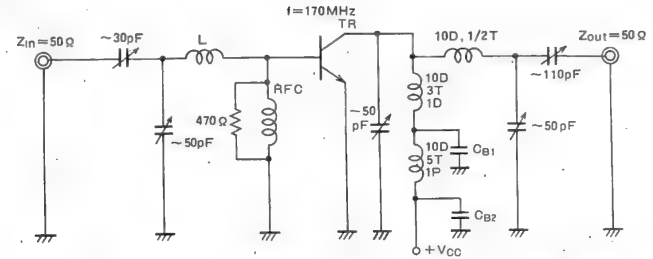
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1	mA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.2A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=3W, f=175MHz	30	35		W
η_C	Collector efficiency		60	70		%

* Note Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

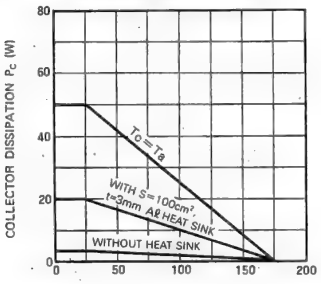


L: Length 10mm
RFC: 0.4mm enameled wire 12T with Ferrite Bead
C_{B1}: 220pF, 2200pF in parallel
C_{B2}: 220pF, 2200pF, 10μF in parallel

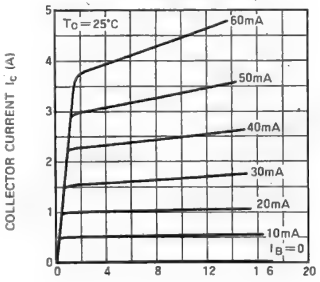
Notes: All coils are made from 1.5mmϕ silver plated copper wire
Coil dimensions in milli-meter
D Inner diameter of coil
T: Turn number of coil
P Pitch of coil

TYPICAL PERFORMANCE DATA

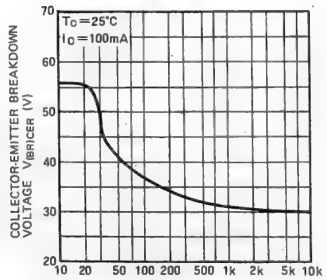
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



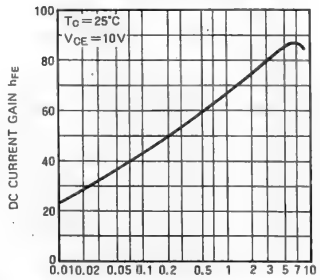
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

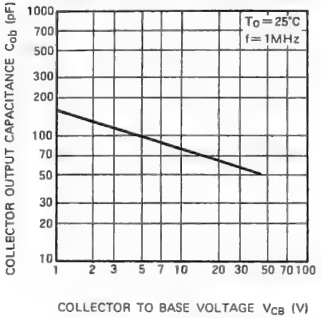


DC CURRENT GAIN VS. COLLECTOR CURRENT

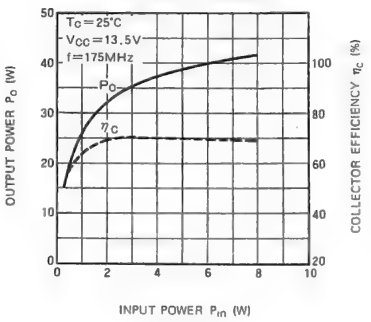


NPN EPITAXIAL PLANAR TYPE

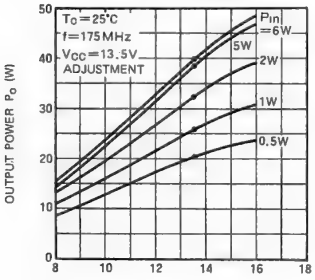
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC1947

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1947 is a silicon NPN epitaxial planar type transistor designed for industrial use RF power amplifiers on VHF band mobile radio applications.

FEATURES

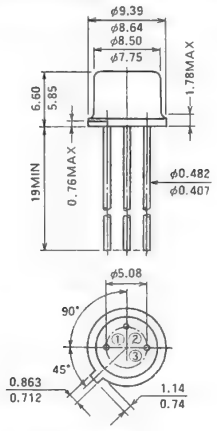
- High power gain: $G_{pe} \geqq 10.7$dB
  @V_{CC} = 13.5V, P_O = 3.5W, f = 175MHz
- TO-39 metal seeled package for high reliability.
- Emitter electrode is connected electrically to the case.

APPLICATION

1 to 3 watt power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① EMITTER (CASE)
② BASE
③ COLLECTOR

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_a=25°C	1	W
		T_C=25°C	10	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65～+175	°C
Rth-a	Thermal resistance	Junction to ambient	150	°C/W
Rth-c		Junction to case	15	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

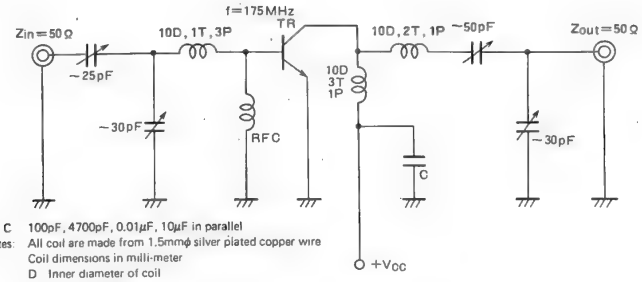
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power **	V_{CC}=13.5V, P_{in}=0.3W, f=175MHz	3.5	4		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_w = 150μs, duty = 5%.
** Note. In case of the case grounded.

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

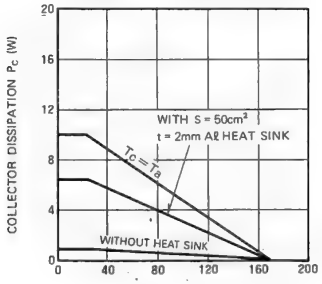


C 100pF, 4700pF, 0.01μF, 10μF in parallel

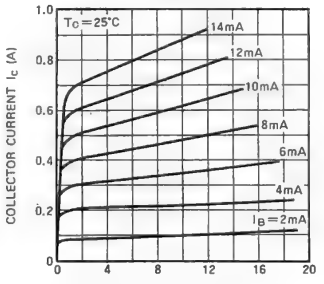
Notes: All coil are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D Inner diameter of coil
T: Turn number of coil
P. Pitch of coil

TYPICAL PERFORMANCE DATA

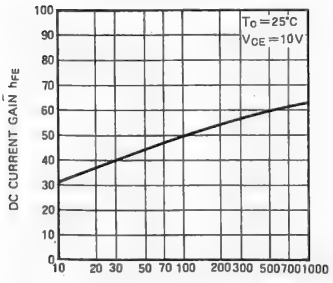
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



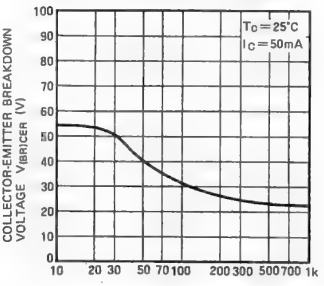
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT



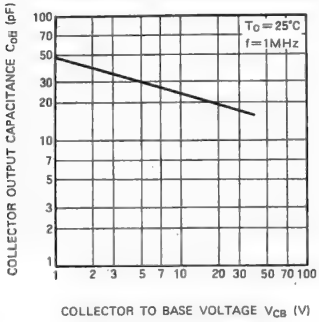
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



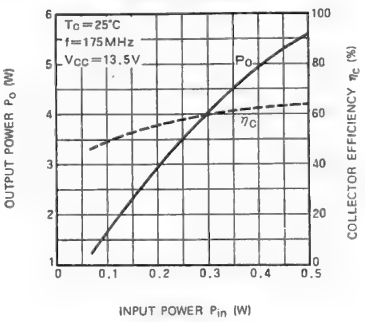
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

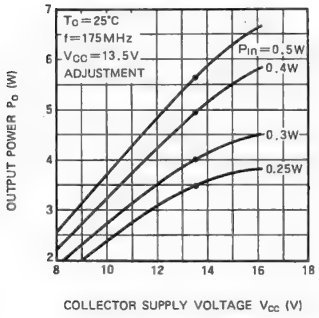
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1965

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1965 is a silicon NPN epitaxial planar type transistor designed for industrial use RF power amplifiers on VHF band mobile radio applications.

FEATURES

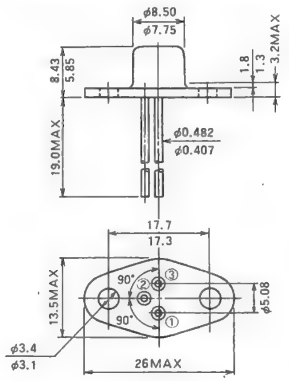
- High power gain: $G_{pe} \geqq 10dB$
  @V_{CC} = 13.5V, P_O = 6W, f = 175MHz
- T_C-17 metal seeled package for high reliability.
- Emitter ballasted construction for good performances.
- Emitter electrode is connected electrically to the case.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W, f = 175MHz, T_C = 25°C.

APPLICATION

4 watt pawer amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_a=25°C	1.5	W
		T_C=25°C	15	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65～+175	°C
Rth-a	Thermal resistance	Junction to ambient	100	°C/W
Rth-c		Junction to case	10	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

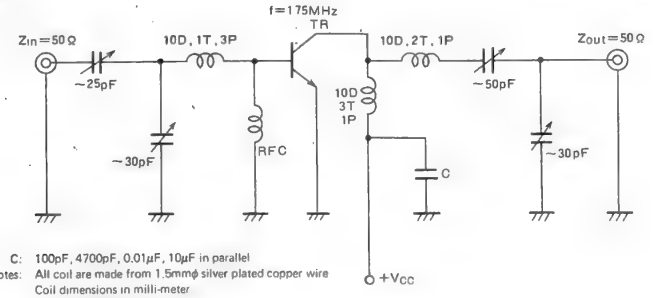
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power **	V_{CC}=13.5V, P_{in}=0.6W, f=175MHz	6	6.5		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_w = 150μs, duty = 5%.
Note: In case of the case grounded.

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

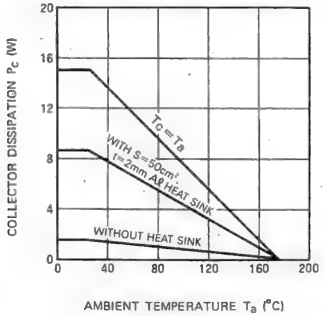
TEST CIRCUIT



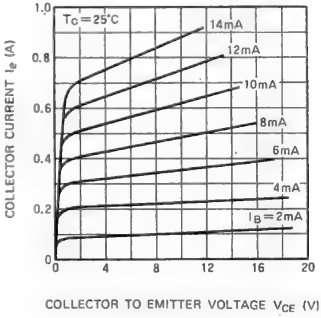
C: 100pF, 4700pF, 0.01μF, 10μF in parallel
Notes: All coil are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
F: Pitch of coil

TYPICAL PERFORMANCE DATA

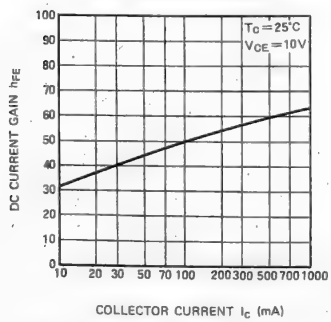
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



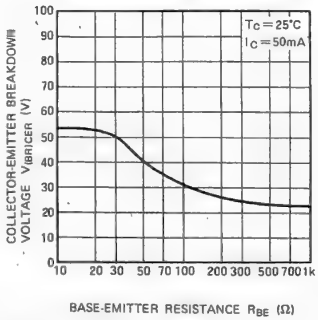
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

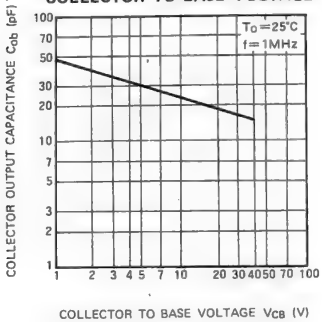


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

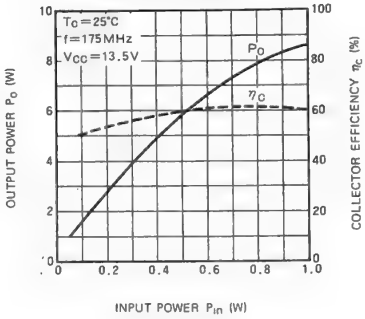


NPN EPITAXIAL PLANAR TYPE

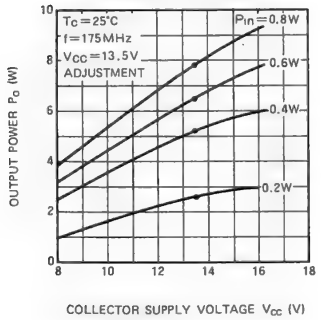
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC1966

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1966 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on UHF band mobile radio applications.

FEATURES

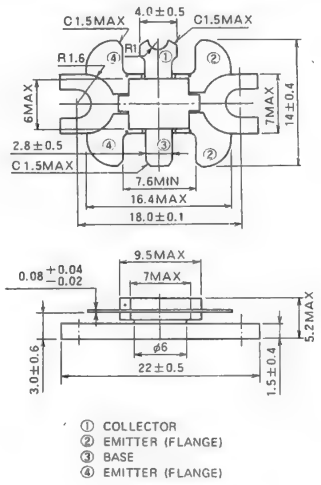
- High power gain: $G_{pe} \geqq 7.8$dB
  @V_{CC} = 13.5V, P_O = 3W, f = 470MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.

APPLICATION

1 to 2 watts output power amplifiers in UHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

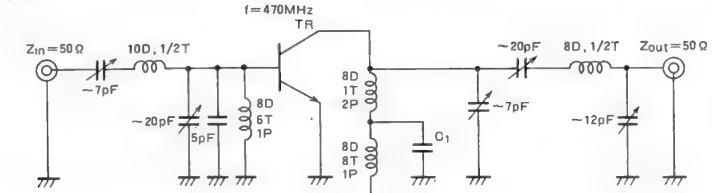
Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_C=25°C	10	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65～+175	°C
Rth-c	Thermal resistance	Junction to case	15	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2.5V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.5W, f=470MHz	3	3.5		W
η_C	Collector efficiency		50	60		%

* Note. Pulse test, P_W = 150μs, duty = 5%

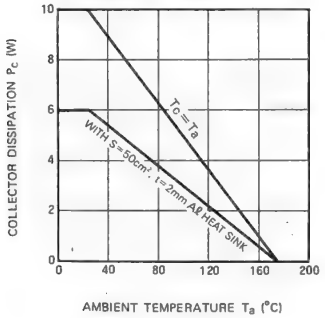
TEST CIRCUIT



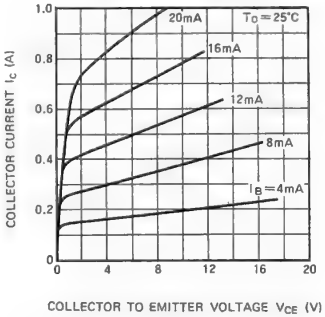
C_1: 2pF, 220pF, 0.1μF, 0.2μF in parallel
C_2: 200pF, 0.01μF, 50μF in parallel
Notes. All coil are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

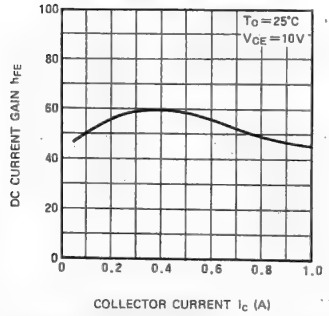
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



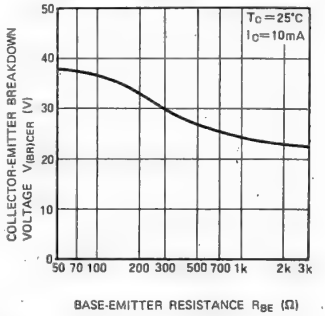
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT



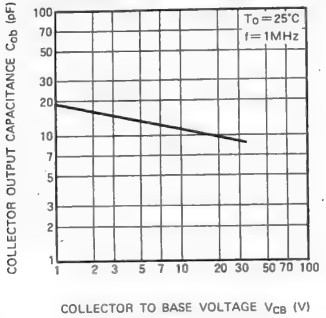
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



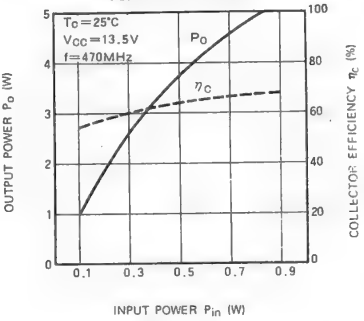
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

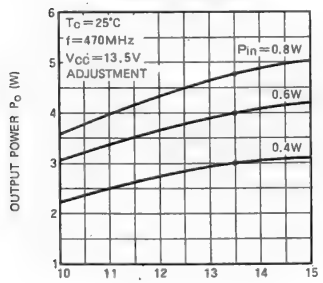
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1967

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1967 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on UHF band mobile radio applications.

FEATURES

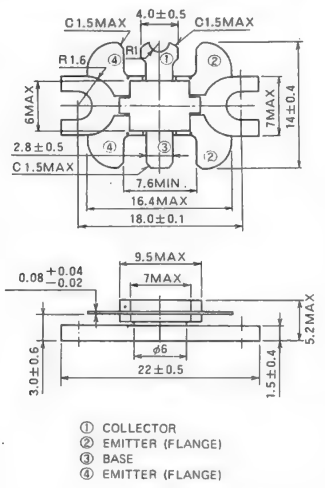
- High power gain: $G_{pe} \geqq 6.7$dB
  @V_{CC} = 13.5V, P_O = 7W, f = 470MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Ability of withstanding more than 20:1 load VSWR all phase when operated at V_{CC} = 15.2V, P_O = 7W, f = 470MHz.
- Low thermal resistance ceramic package with flange.

APPLICATION

3 to 5 watts output power amplifiers in UHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	T_C=25°C	20	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−65～+175	°C
R_{th-c}	Thermal resistance	Junction to case	7.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

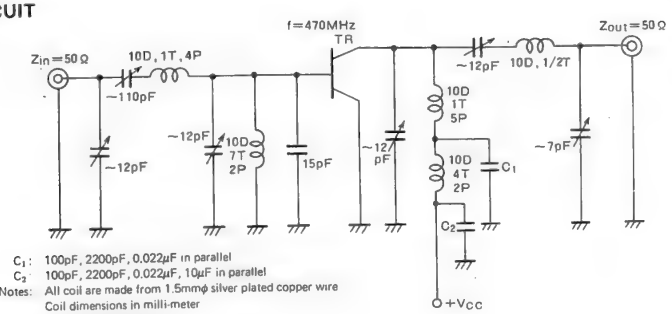
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			200	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			200	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=1.5W, f=470MHz	7	8		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

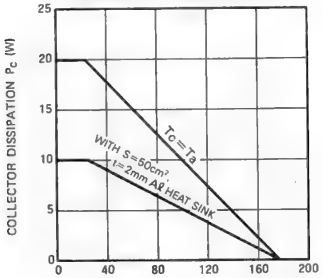
TEST CIRCUIT



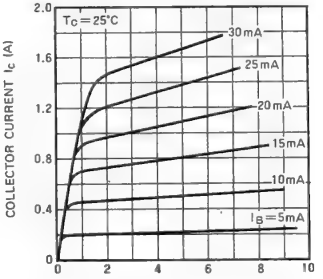
C_1: 100pF, 2200pF, 0.022μF in parallel
C_2: 100pF, 2200pF, 0.022μF, 10μF in parallel
Notes: All coil are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: inner diameter of coil
T: Turn number of coil
P Pitch of coil

TYPICAL PERFORMANCE DATA

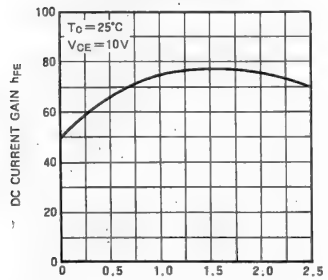
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



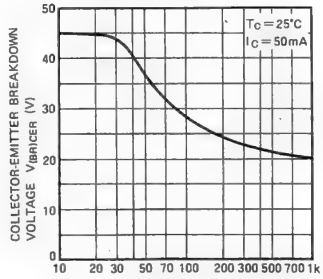
OUTPUT CHARACTERISTICS, COMMON EMITTER



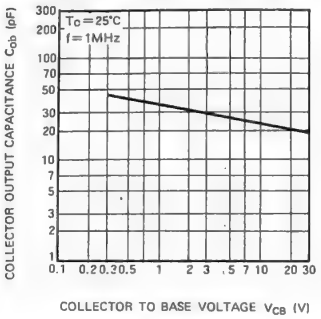
DC CURRENT GAIN VS. COLLECTOR CURRENT



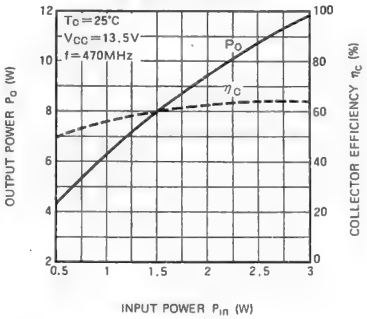
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



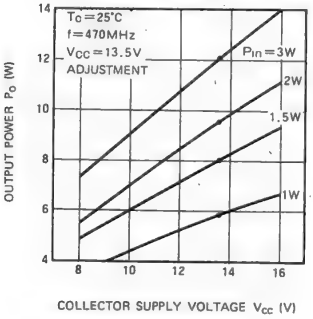
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1968

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1968 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on UHF band mobile radio applications.

FEATURES

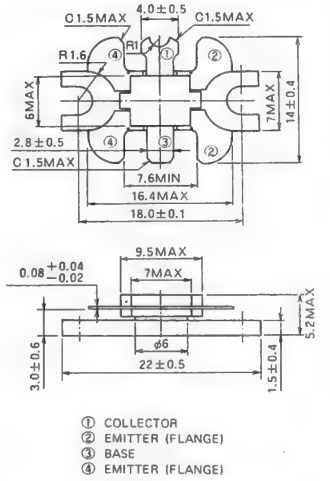
- High power gain: $G_{pe} \geqq 3.7$dB
  @V_{CC} = 13.5V, P_O = 14W, f = 470MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR all phase when operated at V_{CC} = 15.2V, P_O = 18W, f = 470MHz.

APPLICATION

10 to 14 watts output power amplifiers in UHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

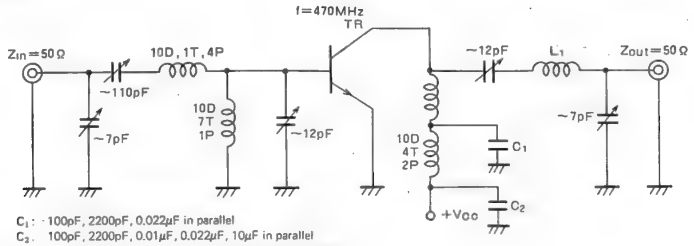
Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	17	V
I_C	Collector current		5	A
P_C	Collector dissipation	Ta=25°C	3	W
		T_C=25°C	40	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65~+175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	3.75	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			400	μA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=6W, f=470MHz	14	16		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

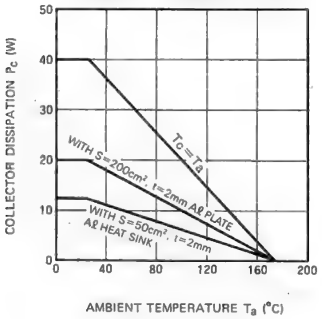
TEST CIRCUIT



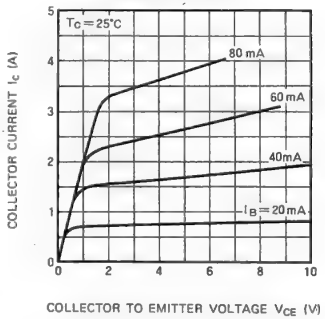
C_1 : 100pF, 2200pF, 0.022μF in parallel
C_2 : 100pF, 2200pF, 0.01μF, 0.022μF, 10μF in parallel
L_1 : Length 4mm, width 8mm, thickness 0.3mm copper plate
Notes: All coil are made from 1.5 mmϕ silver plated copper wire except L_1
Coil dimensions in milli-meter
D Inner diameter of coil
T Turn number of coil
P Pitch of coil

TYPICAL PERFORMANCE DATA

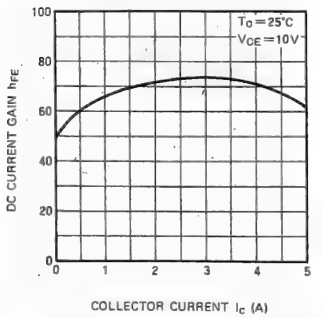
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



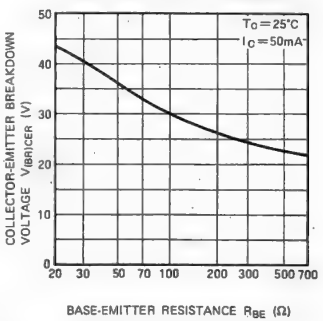
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT



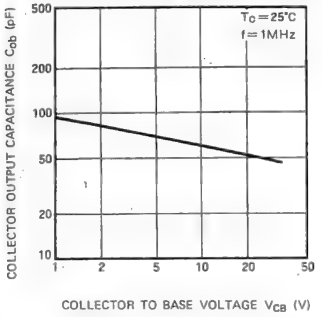
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



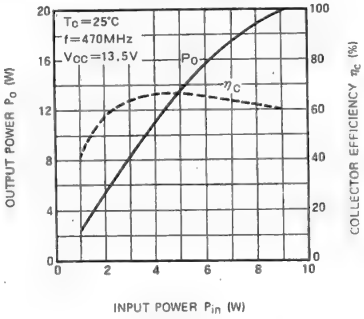
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

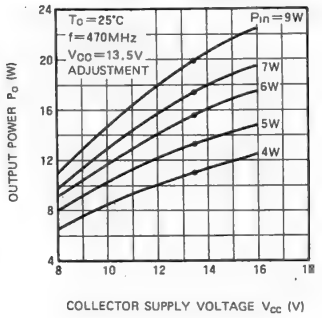
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1968A

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1968A is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on UHF band mobile radio applications.

FEATURES

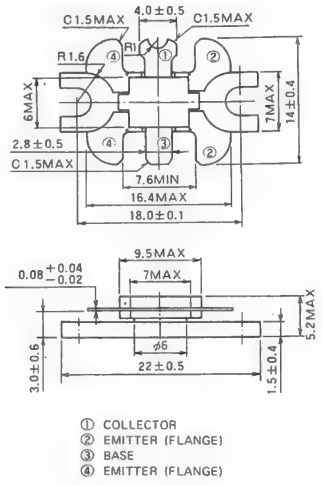
- High power gain: $G_{pe} \geqq 5.4$dB
  @V_{CC} = 13.5V, P_O = 14W, f = 470MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR all phase when operated at V_{CC} = 15.2V, P_O = 18W, f = 470MHz.

APPLICATION

10 to 14 watts output power amplifiers in UHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		5	A
P_C	Collector dissipation	Ta=25°C	3	W
		T_C=25°C	40	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65~+175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	3.75	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

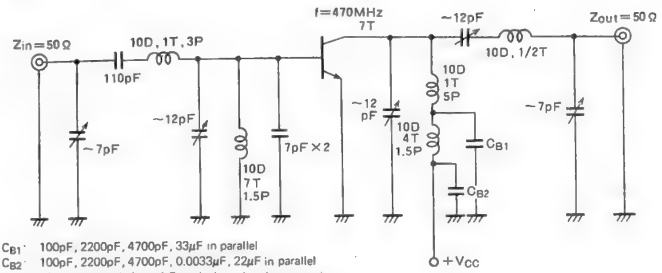
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			400	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=4W, f=470MHz	14	16		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

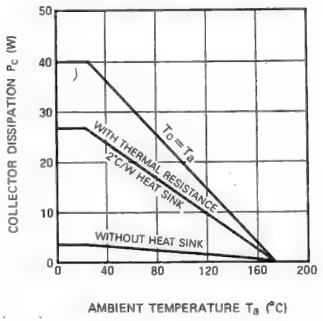
TEST CIRCUIT



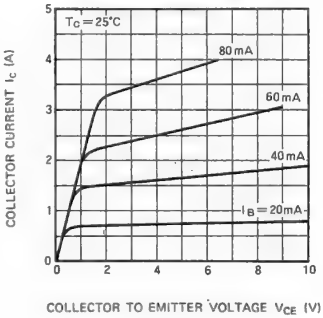
C_{B1}: 100pF, 2200pF, 4700pF, 33μF in parallel
C_{B2}: 100pF, 2200pF, 4700pF, 0.0033μF, 22μF in parallel
Notes: All coil are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

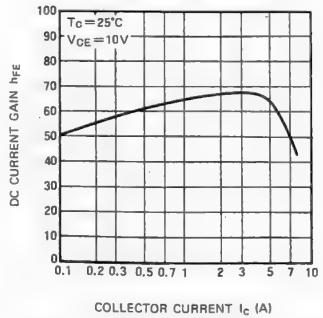
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



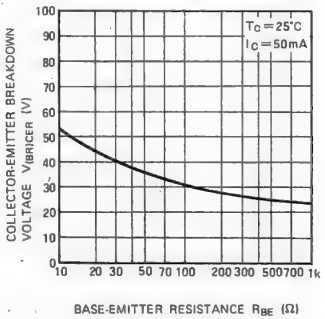
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

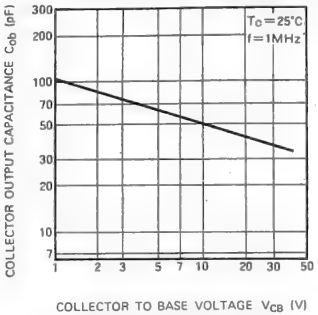


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

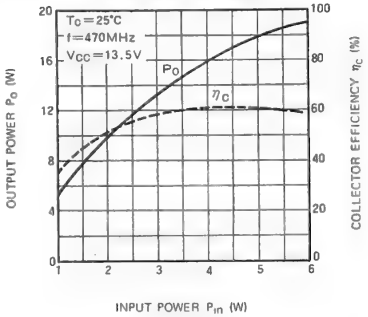


NPN EPITAXIAL PLANAR TYPE

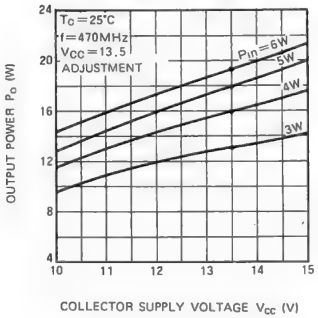
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC1969

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1969 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on HF band mobile radio applications.

FEATURES

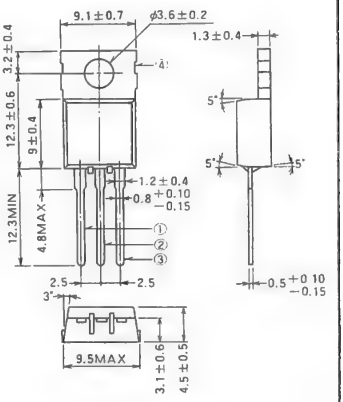
- High power gain: $G_{pe} \geqq 12$dB
  @V_{CC} = 12V, P_O = 16W, f = 27MHz
- Emitter ballasted construction for high reliaiblity and good performances.
- TO-220 package similarly is combinient for mounting.
- Ability of withstanding infinite load VSWR when operated at V_{CC} = 16V, P_O = 20W, f = 27MHz.

APPLICATION

10 to 14 watts output power class AB amplifiers applications in HF band.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		60	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	25	V
I_C	Collector current		6	A
P_C	Collector dissipation	T_a=25°C	1.7	W
		T_C=25°C	20	W
T_j	Junction temperature		+150	°C
T_{stg}	Storage temperature		−55~+150	°C
Rth-a	Thermal resistance	Junction to ambient	73.5	°C/W
Rth-c		Junction to case	6.25	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	60			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=∞	25			V
I_{CBO}	Collector cutoff current	V_{CB}=30V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=4V, I_C=0			100	μA
h_{FE}	DC forward current gain*	V_{CE}=12V, I_C=10mA	10	50	180	—
P_O	Output power	V_{CC}=12V, Pin=1w, f=27MHz	16	18		W
η_C	Collector efficiency		60	70		%

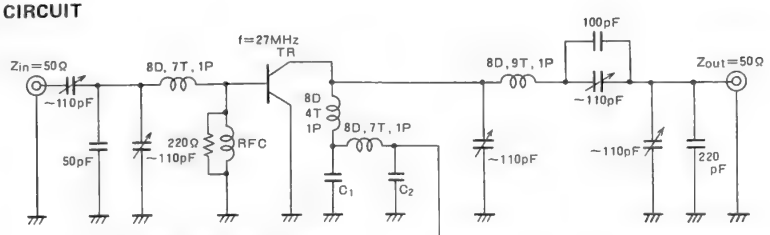
* Note: Pulse test, P_W = 150μs, duty = 5%, h_{FE} classification.

Item	X	A	B	C	D
h_{FE}	10~25	20~45	35~70	55~110	90~180

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

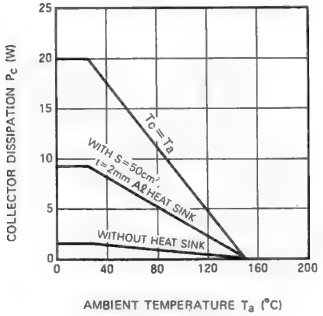
TEST CIRCUIT



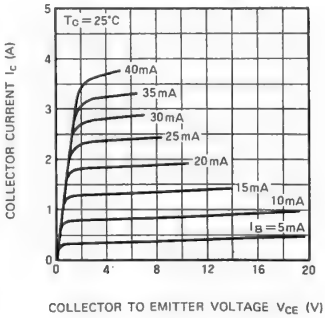
C_1: 0.01μF, 4700pF, 2200pF, 100pF, 10pF in parallel
C_2: 10μF, 0.05μF, 820pF, 100pF in parallel
Notes: All coil are made from 1.0mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

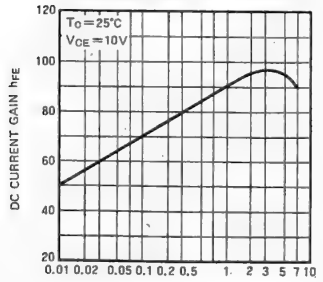
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



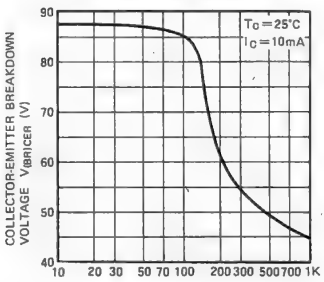
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



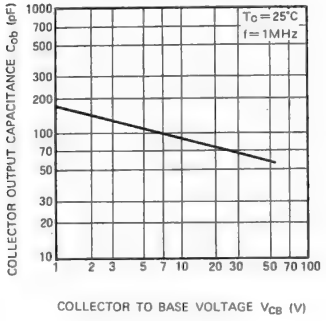
DC CURRENT GAIN VS. COLLECTOR CURRENT



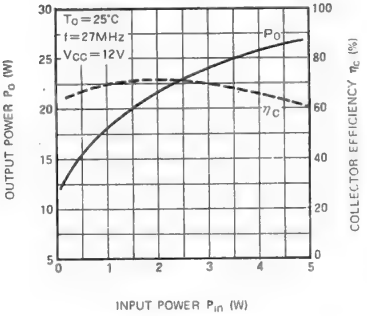
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

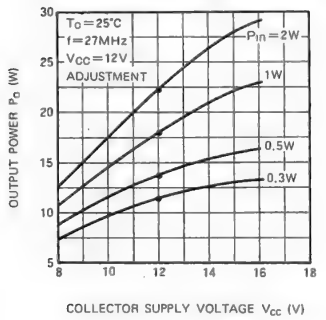
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



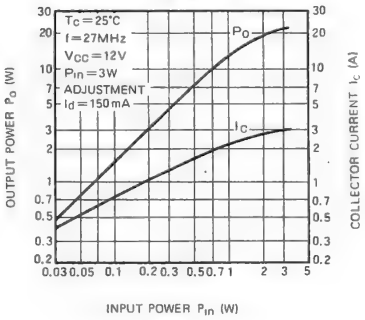
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



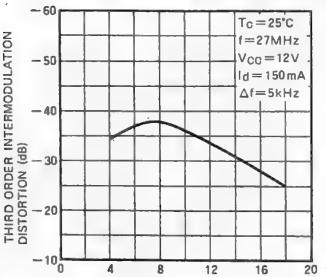
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



IN CASE AB OPERATING OUTPUT POWER COLLECTOR CURRENT VS. INPUT POWER



THIRD ORDER INTERMODULATION DISTORTION VS. OUTPUT POWER



2SC1970

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1970 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio applications.

FEATURES

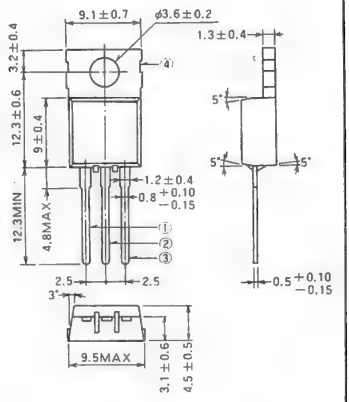
- High power gain: $G_{pe} \geqq 9.2$dB
  @V_{CC} = 13.5V, P_O = 1W, f = 175MHz
- Emitter ballasted construction, gold metallization for high reliability and good performances.
- TO-220 package similarly is combinient for mounting.

APPLICATION

0.8 to 1 watts output power amplifiers and driver in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① BASE
② COLLECTOR (FIN)
③ EMITTER
④ FIN (COLLECTOR)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		0.6	A
P_C	Collector dissipation	T_a=25°C	1	W
		T_C=25°C	5	W
T_j	Junction temperature		+150	°C
Tstg	Storage temperature		−55~+150	°C
Rth-a	Thermal resistance	Junction to ambient	125	°C/W
Rth-c		Junction to case	25	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

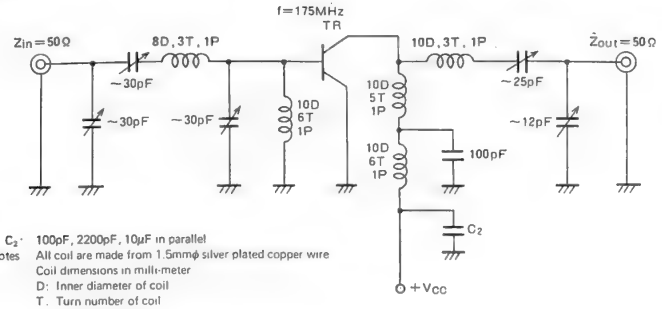
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=5mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.12W, f=175MHz	1	1.3		W
η_C	Collector efficiency		50	60		%

* Note. Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

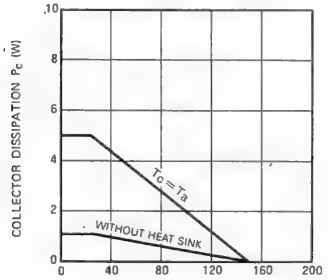


C_2: 100pF, 2200pF, 10μF in parallel

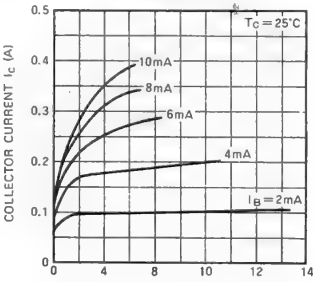
Notes: All coil are made from 1.5mmϕ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
F: Pitch of coil

TYPICAL PERFORMANCE DATA

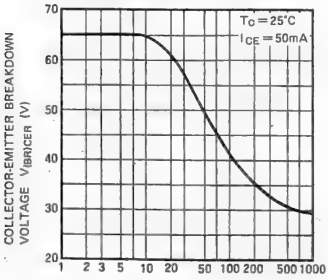
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



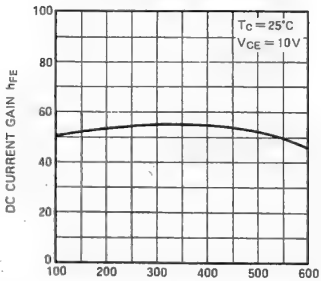
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

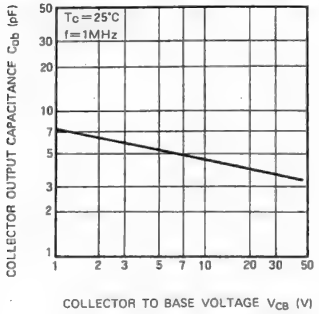


DC CURRENT GAIN VS. COLLECTOR CURRENT

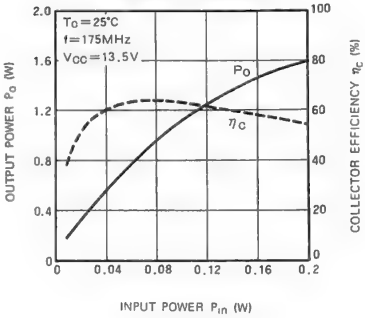


NPN EPITAXIAL PLANAR TYPE

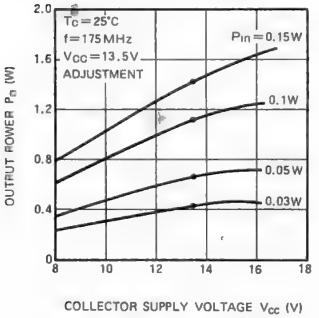
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC1971

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1971 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio applications.

FEATURES

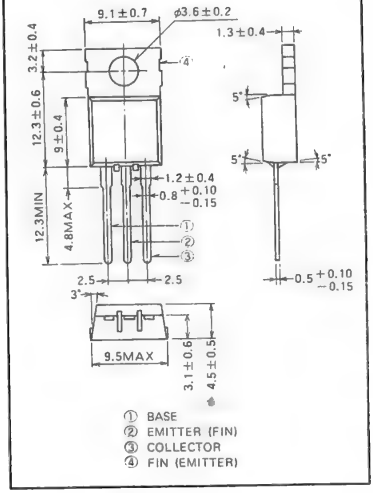
- High power gain: $G_{pe} \geqq 10dB$
  @V_{CC} = 13.5V, P_O = 6W, f = 175MHz
- Emitter ballasted construction, gold metallization for high reliability and good performances.
- TO-220 package similar is combinient for mounting.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W, f = 175MHz.

APPLICATION

4 to 5 watts output power amplifiers in VHF band applications.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

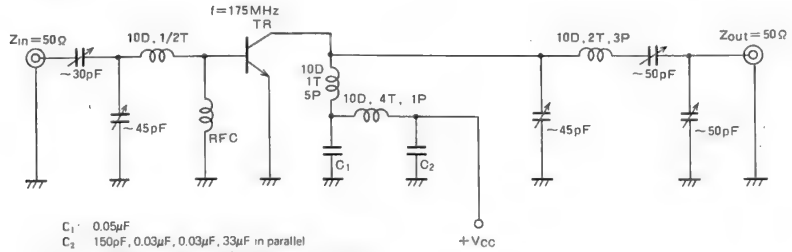
Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	17	V
I_C	Collector current		12	A
P_C	Collector dissipation	T_a=25°C	1.5	W
		T_C=25°C	12.5	W
T_j	Junction temperature		+150	°C
Tstg	Storage temperature		−55～+150	°C
Rth-a	Thermal resistance	Junction to ambient	83	°C/W
Rth-c		Junction to case	10	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.6W, f=175MHz	6	7		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

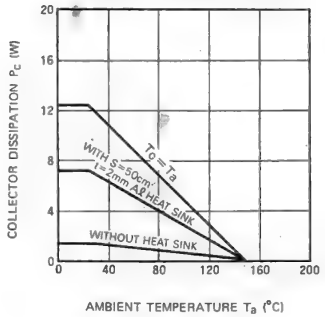
TEST CIRCUIT



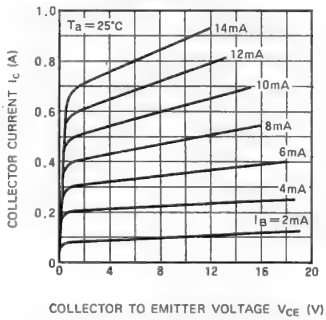
C_1 0.05μF
C_2 150pF, 0.03μF, 0.03μF, 33μF in parallel
Notes All coils are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D Inner diameter of coil
T Turn number of coil
P Pitch of coil

TYPICAL PERFORMANCE DATA

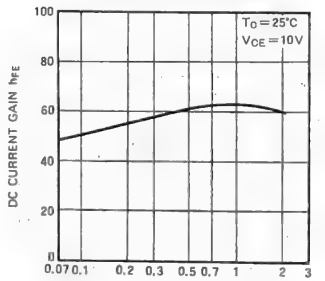
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



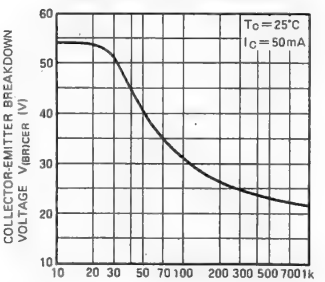
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT



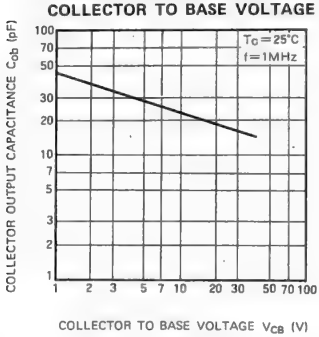
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



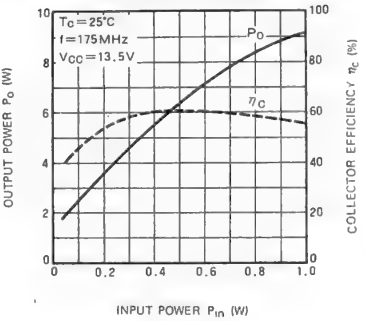
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

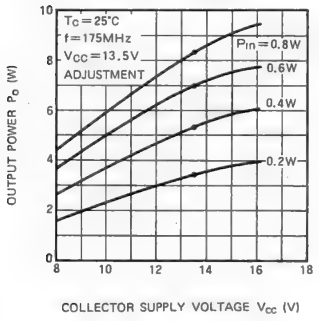
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1972

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1972 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio applications.

FEATURES

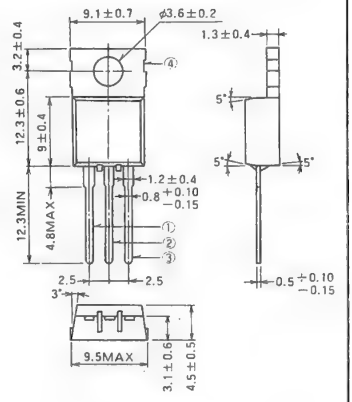
- High power gain: $G_{pe} \geqq 7.5$dB
  @V_{CC} = 13.5V, P_O = 14W, f = 175MHz
- Emitter ballasted construction, gold metallization for high reliability and good performances.
- TO-220 package similar is combinient for mounting.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 18W, f = 175MHz.

APPLICATION

10 to 14 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① BASE
② EMITTER (FIN)
③ COLLECTOR
④ FIN (EMITTER)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		3.5	A
P_C	Collector dissipation	T_a=25°C	1.5	W
		T_C=25°C	25	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	100	°C/W
Rth-c		Junction to case	6	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

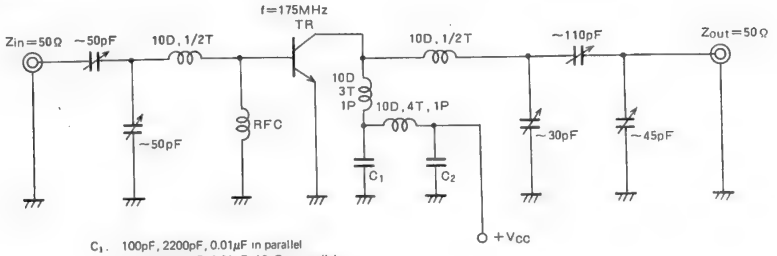
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1000	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=2.5W, f=175MHz	14	15		W
η_C	Collector efficiency		60	70		%

* Note Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

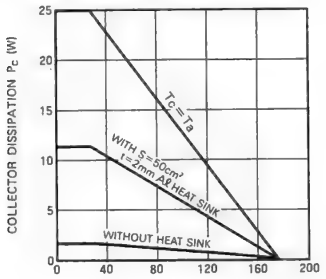
TEST CIRCUIT



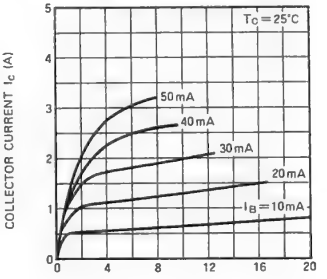
C_1: 100pF, 2200pF, 0.01μF in parallel
C_2: 100pF, 2200pF, 0.01μF, 10μF in parallel
Notes: All coil are made from 1.5mmΦ silver plated copper wire
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

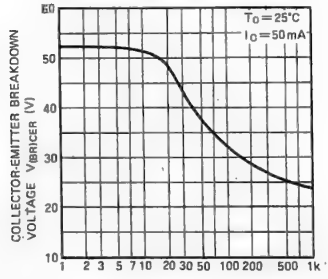
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



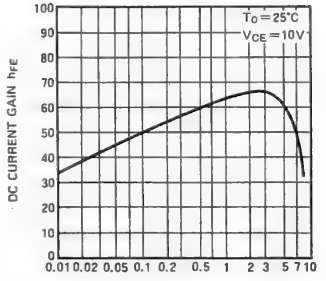
OUTPUT CHARACTERISTICS, COMMON EMITTER



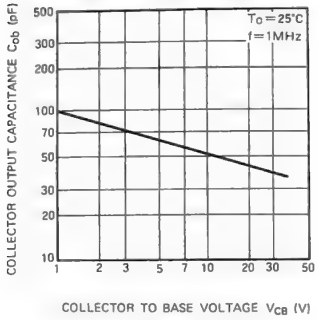
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



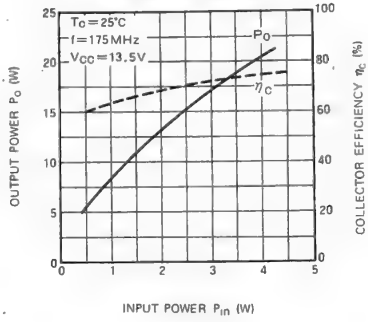
DC CURRENT GAIN VS. COLLECTOR CURRENT



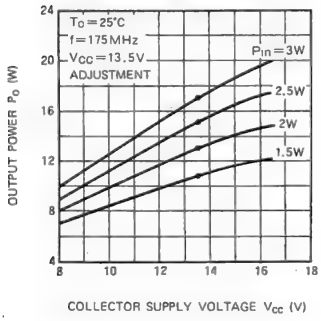
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2053

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2053 is a silicon NPN epitaxial planar type transistor designed for RF amplifiers on VHF band mobile radio applications.

FEATURES

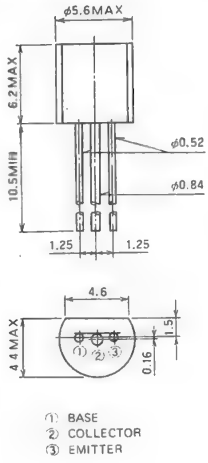
- High power gain: $G_{pe} \geqq 15.7$dB
  @V_{CC} = 13.5V, P_O = 0.15W, f = 175MHz
- Emitter ballasted construction, gold metallization for high reliability and good performances.
- TO-92 similar package is combinient for mounting.

APPLICATION

Driver amplifiers in general in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise specified)

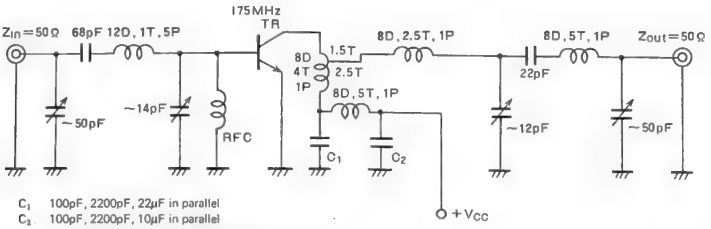
Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		0.3	A
P_C	Collector dissipation	T_a = 25°C	0.6	W
T_j	Junction temperature		+135	°C
Tstg	Storage temperature		−55 ~ +135	°C
Rth-a	Thermal resistance	Junction to ambient	183	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 1mA, I_O = 0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 1mA, I_E = 0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 10mA, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB} = 15V, I_E = 0			20	μA
I_{EBO}	Emitter cutoff current	V_{EB} = 3V, I_C = 0			20	μA
h_{FE}	DC forward current gain *	V_{CE} = 10V, I_O = 10mA	10	50	180	—
P_O	Output power	V_{CC} = 13.5V, P_{in} = 4mW, f = 175MHz	150	200		mW
η_C	Collector efficiency		40	50		%

* Note. Pulse test, P_W = 150μs, duty = 5%

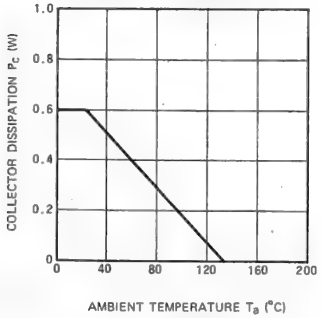
TEST CIRCUIT



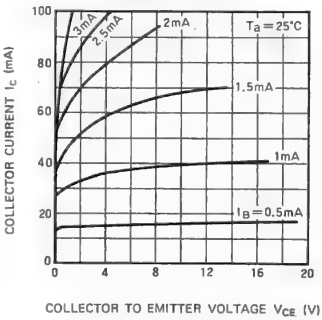
C_1 100pF, 2200pF, 22μF in parallel
C_2 100pF, 2200pF, 10μF in parallel
Notes. All coil are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D. Inner diameter of coil
T. Turn number of coil
P. Pitch of coil

TYPICAL PERFORMANCE DATA

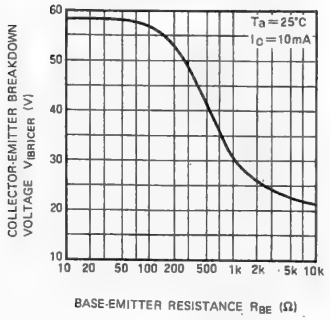
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



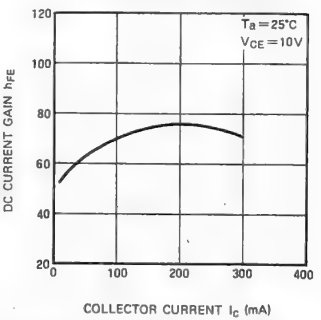
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



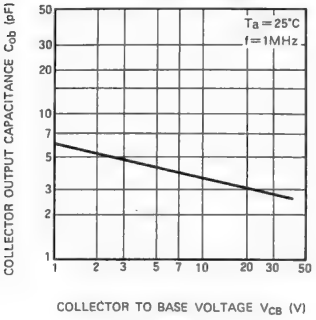
DC CURRENT GAIN VS. COLLECTOR CURRENT



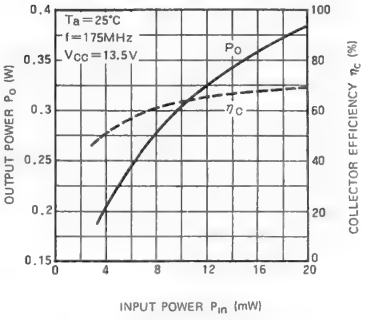
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

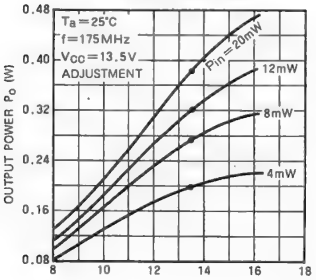
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2055

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2055 is a silicon NPN epitaxial planar type transistor designed for RF amplifiers on VHF band portable or hand-held radio applications.

FEATURES

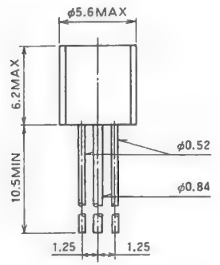
- High power gain: $G_{pe} \geqq 13$dB
  @V_{CC} = 7.2V, P_O = 0.2W, f = 175MHz
- Emitter ballasted construction, gold metallization for high reliability and good performances.
- TO-92 similar package is combinient for mounting.

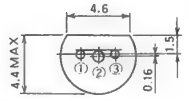
APPLICATION

Driver amplifiers in general in VHF band portable or hand-held radio applications.

OUTLINE DRAWING

Dimensions in mm





① BASE
② COLLECTOR
③ EMITTER

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		18	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		0.3	A
P_C	Collector dissipation	T_a=25°C	0.5	W
T_j	Junction temperature		+135	°C
Tstg	Storage temperature		−55~+135	°C
Rth-a	Thermal resistance	Junction to ambient	220	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

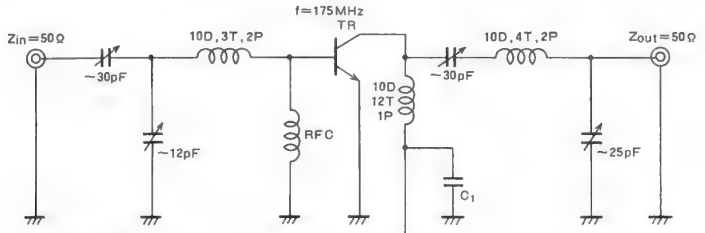
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	18			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cutoff current	V_{CB}=10V, I_E=0			30	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			30	μA
h_{FE}	DC forward current gain *	V_{CE}=7V, I_C=50mA	10	50	180	—
P_O	Output power	V_{CC}=7.2V, P_{in}=10mW, f=175MHz	0.2	0.25		W
η_C	Collector efficiency		50	60		%

* Note. Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

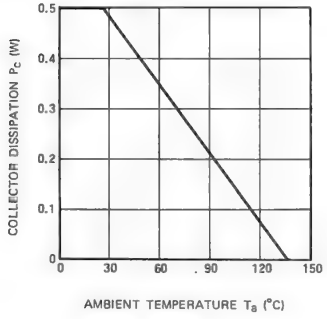


C_1: 33μF, 0.047μF, 0.022μF x2, 0.01μF in parallel

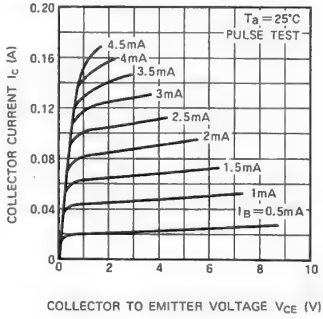
Notes. All coil are made from 1.0mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

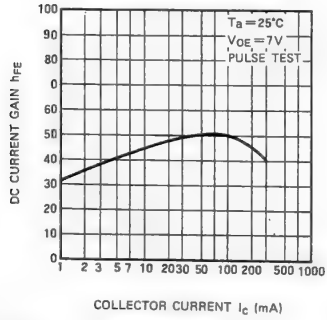
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



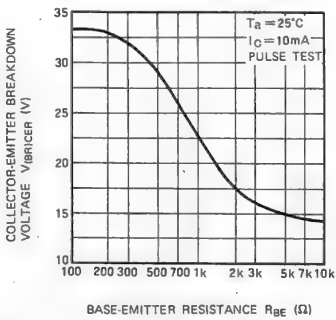
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

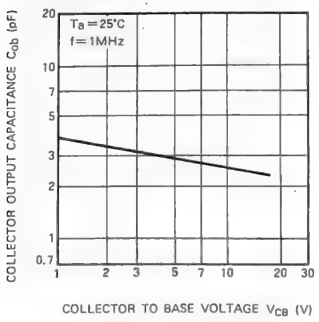


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

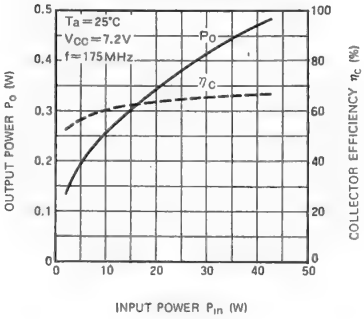


NPN EPITAXIAL PLANAR TYPE

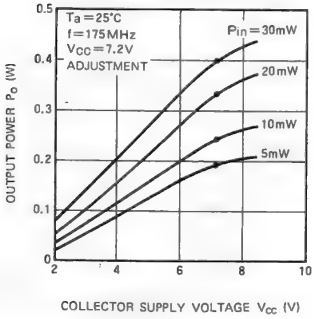
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2056

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2056 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band portable or hand-held radio applications.

FEATURES

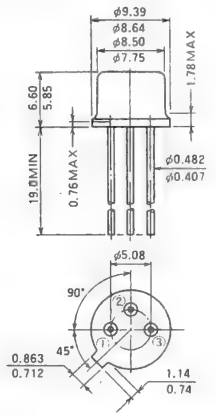
- High power gain: $G_{pe} \geqq 9dB$
  @V_{CC} = 7.2V, P_O = 1.6W, f = 175MHz
- TO-39 metal seeled package for high reliability.
- Emitter ballasted construction, gold metallization for good performances.
- Emitter electrode is connected electrically to the case.

APPLICATION

1 to 1.5 watt power amplifiers in VHF band portable or hand-held radio applications.

OUTLINE DRAWING

Dimensions in mm



① EMITTER (CASE)
② BASE
③ COLLECTOR

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		18	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		0.6	A
P_C	Collector dissipation	T_a=25°C	0.8	W
		T_C=25°C	4	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	187.5	°C/W
Rth-c		Junction to case	37.5	°C/W

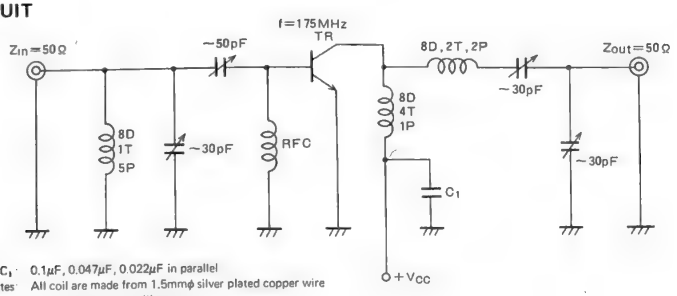
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	18			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cutoff current	V_{CB}=10V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			100	μA
h_{FE}	DC forward current gain*	V_{CE}=7V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=7.2V, P_{in}=0.2W, f=175MHz	1.6	2		W
η_C	Collector efficiency		55	60		%

* Note. Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

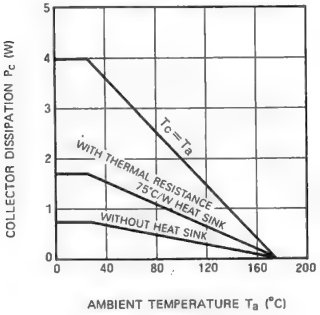


C_1: 0.1μF, 0.047μF, 0.022μF in parallel

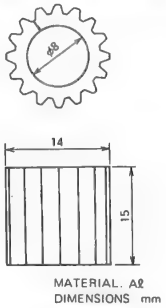
Notes: All coil are made from 1.5mmϕ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

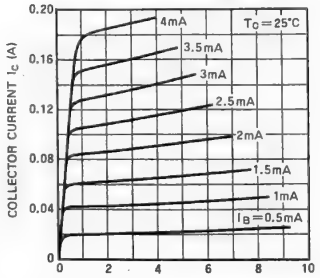
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



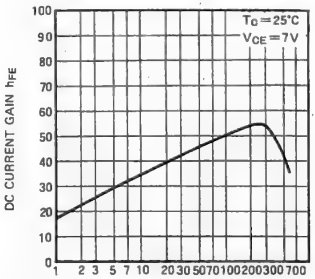
THERMAL RESISTANCE 75°C/W HEAT SINK OUTLINE DRAWING



OUTPUT CHARACTERISTICS, COMMON EMITTER



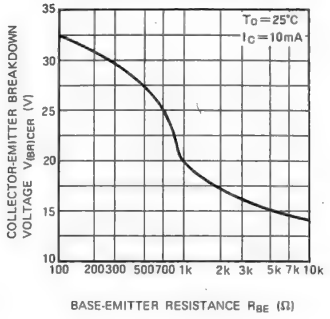
DC CURRENT GAIN VS. COLLECTOR CURRENT



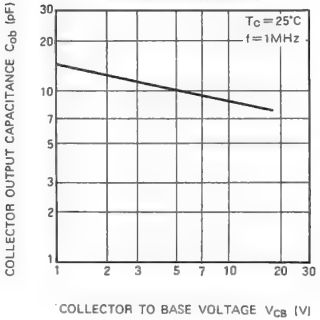
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

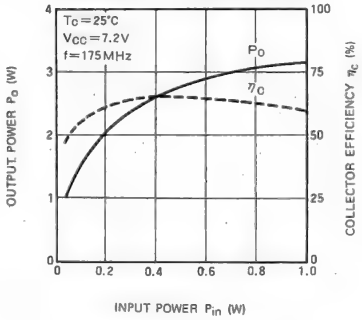
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



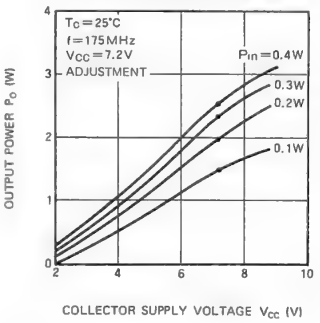
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2086

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2086 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in HF band mobile radio applications.

FEATURES

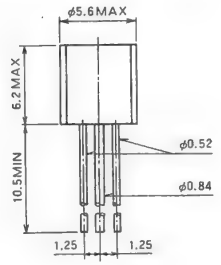
- High power gain: $G_{pe} \geqq 13dB$
  @V_{CC} = 12V, P_o = 0.3W, f = 27MHz
- Emitter ballasted construction, gold metallization for good performances.
- TO-92 similar package with low thermal resistance.

APPLICATION

Driver amplifiers in general in HF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① BASE
② COLLECTOR
③ EMITTER

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		75	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	35	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_a = 25°C	0.8	W
T_j	Junction temperature		+135	°C
T_{stg}	Storage temperature		−55 ~ +135	°C
R_{th-a}	Thermal resistance	Junction to ambient	137.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise specified)

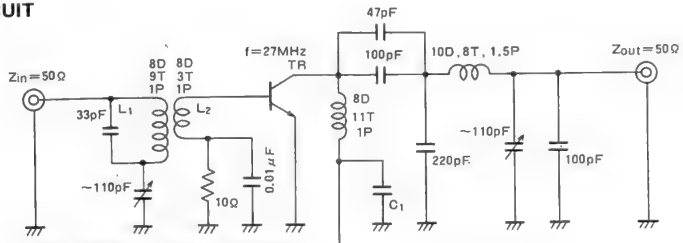
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 1mA, I_C = 0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 1mA, I_E = 0	75			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 10mA, $R_{BE} = \infty$	35			V
I_{CBO}	Collector cutoff current	V_{CB} = 35V, I_E = 0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB} = 3V, I_C = 0			100	μA
h_{FE}	DC forward current gain*	V_{CE} = 10V, I_C = 0.1A	35	70	300	—
P_O	Output power	V_{CC} = 12V, P_{in} = 15mW, f = 27MHz	0.3	0.45		W
η_C	Collector efficiency		50	60		%

* Note. Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT



C_1: 33μF, 0.033μF, 0.01μF, 330pF, 100pF in parallel

Notes: L_1 and L_2 are reeled same core by turns but L_2 is made from 0.8mmϕ enamel wire

Coils are made from 1.0mmϕ silver plated copper wire,

D: Inner diameter of coil

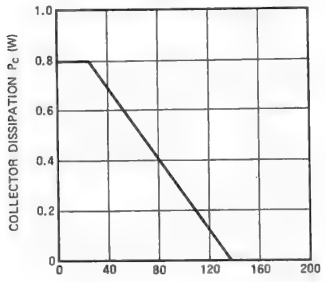
T: Turn number of coil

P: Pitch of coil

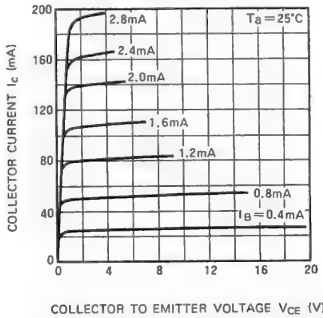
Coils dimensions in milli-meter

TYPICAL PERFORMANCE DATA

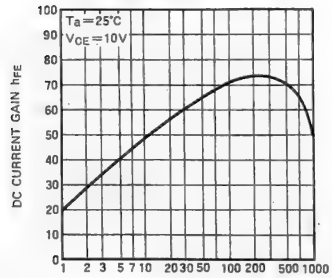
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



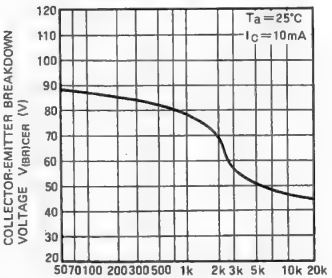
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

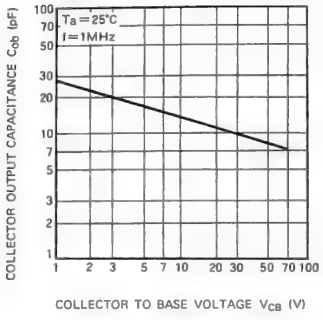


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

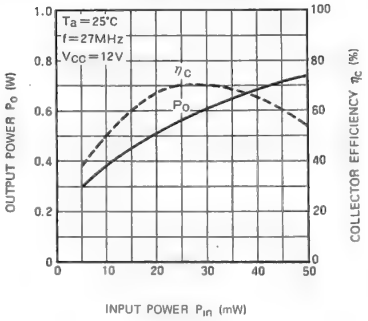


NPN EPITAXIAL PLANAR TYPE

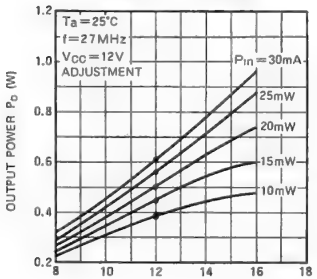
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2094

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2094 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

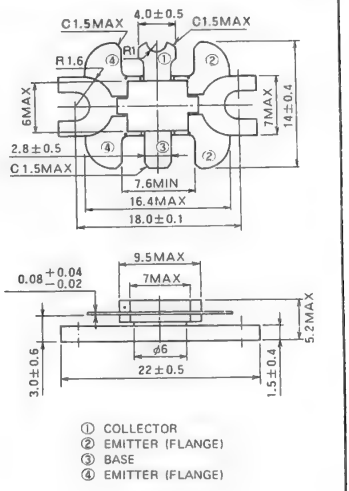
- High power gain: $G_{pe} \geqq 8.8$dB
  @V_{CC} = 13.5V, P_O = 15W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 18W, f = 175MHz.
- Low intermodulation distortion: IMD –30dB (typ) @15WPEP

APPLICATION

10 to 14 watts output linear power amplifiers in VHF band.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		3.5	A
P_C	Collector dissipation	T_a=25°C	2	W
		T_C=25°C	30	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	75	°C/W
Rth-c		Junction to case	5	°C/W

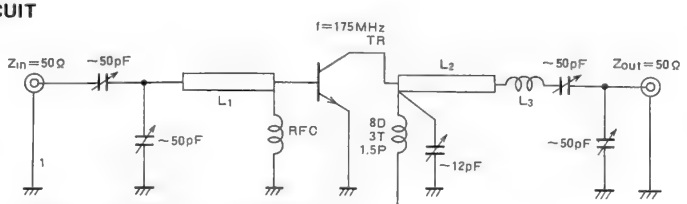
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			0.5	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=2W, f=175MHz	15	17.5		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

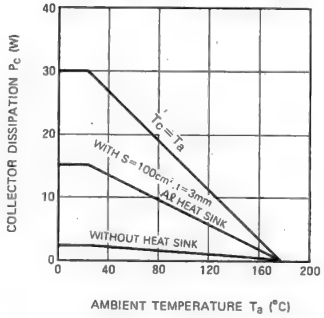
TEST CIRCUIT



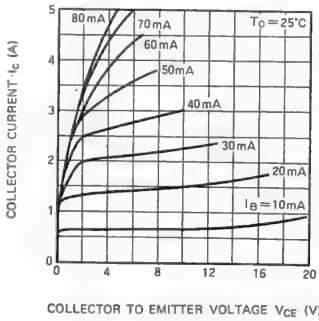
L_1: Width, 4mm, length 58mm, PCB (t = 1.6mm glass epoxy)
L_2: Width 4mm, length 42mm, PCB (t = 1.6mm glass epoxy)
L_3: 10D, 1T, 1.0mmϕ silver plated copper wire
C_1: 220pF, 2200pF, 2200pF in parallel
C_2: 0.01μF, 1μF in parallel
Notes. All coil are made from 1.5 mmϕ silver plated copper wire except L_1, L_2, L_3 & RFC
D: inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

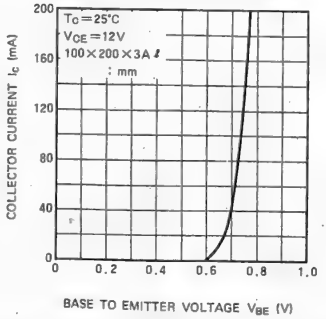
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



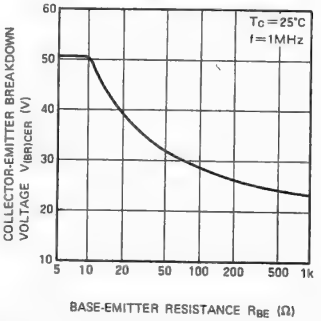
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR CURRENT VS. BASE TO EMITTER VOLTAGE



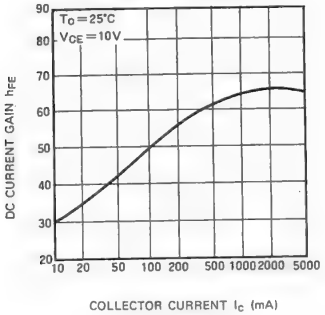
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



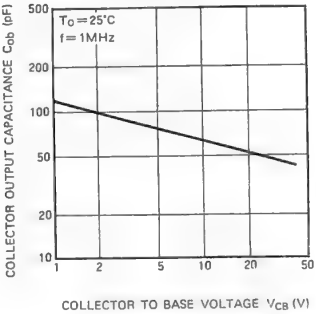
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

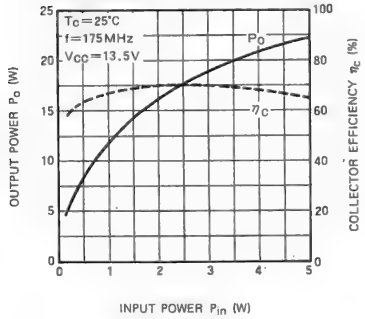
DC CURRENT GAIN VS. COLLECTOR CURRENT



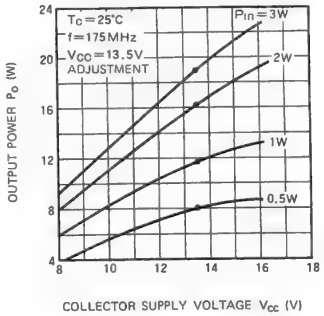
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



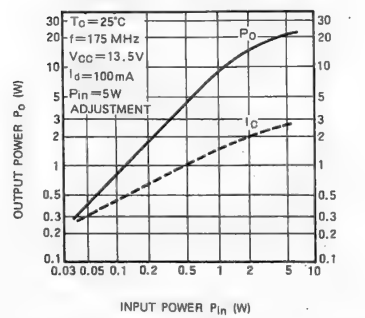
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



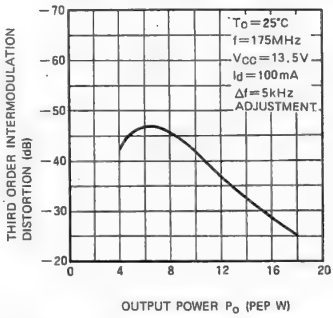
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



IN CASE AB OPERATING OUTPUT POWER COLLECTOR CURRENT VS. INPUT POWER



THIRD ORDER INTERMODULATION DISTORTION VS. OUTPUT POWER



2SC2097

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2097 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in HF band mobile radio applications.

FEATURES

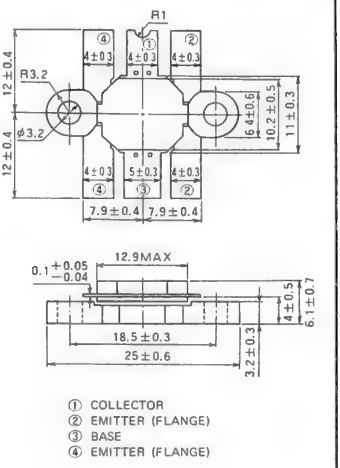
- High power gain: $G_{pe} \geqq 12.3$dB
  @V_{CC} = 13.5V, P_O = 75W, f = 30MHz
- Emitter ballasted construction for good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding infinite load VSWR when operated at V_{CC} = 15.2V, P_O = 70W, f = 30MHz, T_C = 25°C.

APPLICATION

HF band linear power amplifiers in push-pull class AB operation.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	20	V
I_C	Collector current		15	A
P_C	Collector dissipation	T_a=25°C	7.5	W
		T_C=25°C	125	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
$R_{th\text{-}a}$	Thermal resistance	Junction to ambient	20	°C/W
$R_{th\text{-}c}$		Junction to case	1.2	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

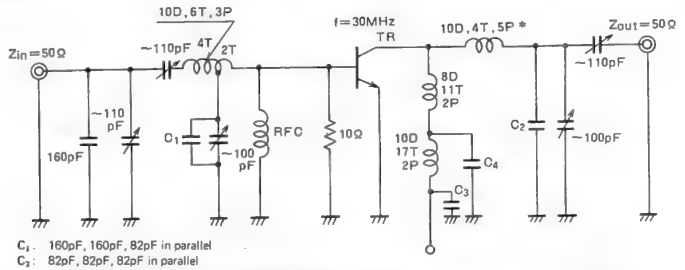
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=20mA, I_E=0	50			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	20			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			4	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=4W, f=30MHz	75	85		W
η_C	Collector efficiency		55	65		%

* Note. Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

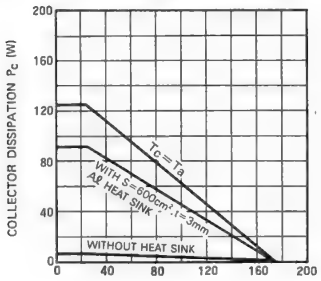
TEST CIRCUIT



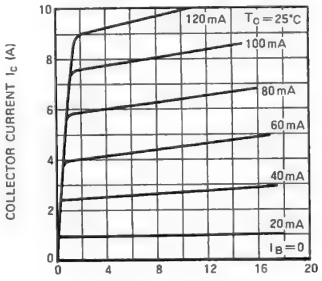
C_1: 160pF, 160pF, 82pF in parallel
C_2: 82pF, 82pF, 82pF in parallel
C_3: 100pF, 4700pF, 4700pF, 0.22μF, 0.22μF, 33μF, 330μF in parallel
C_4: 100pF, 220pF, 4700pF, 0.1μF, 330μF in parallel
RFC: 1mmφ enameled wire 27T.
Notes: All coils are made from 1.5mmφ silver plated copper wire but coil (sign *) is made from 2.3mmφ
D Inner diameter of coil P: Pitch of coil
T Turn number of coil Dimension in milli-meter

TYPICAL PERFORMANCE DATA

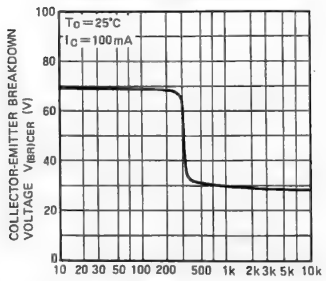
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



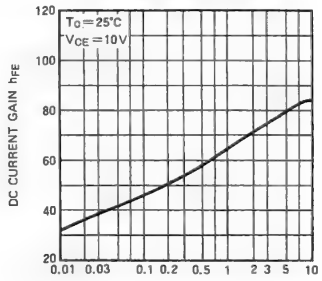
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

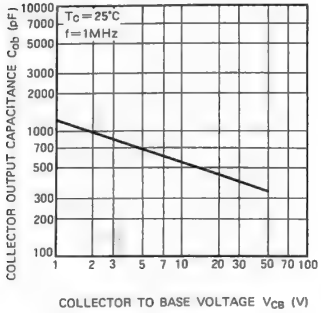


DC CURRENT GAIN VS. COLLECTOR CURRENT

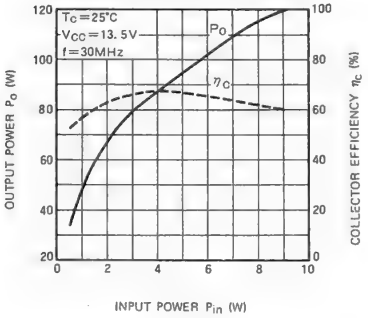


NPN EPITAXIAL PLANAR TYPE

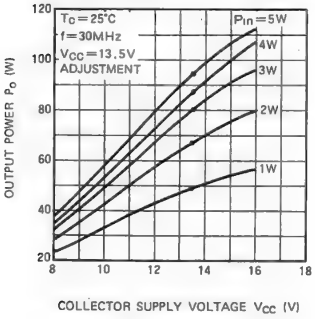
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2131

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2131 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in UHF band mobile radio applications.

FEATURES

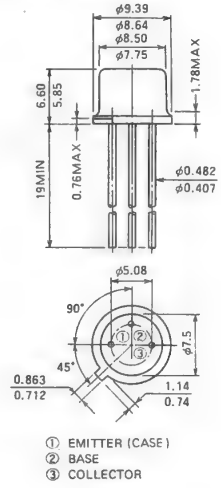
- High power gain: $G_{pe} \geqq 6.7$dB
  @V_{CC} = 13.5V, P_O = 1.4W, f = 500MHz
- TO-39 metal seeled package for high reliability.
- Emitter ballasted construction, gold metallization for good performances.
- Emitter electrode is connected electrically to the case.

APPLICATION

1 watt power amplifiers in UHF band mobile radio applications and driver amplifiers in general.

OUTLINE DRAWING

Dimensions in mm



① EMITTER (CASE)
② BASE
③ COLLECTOR

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	18	V
I_C	Collector current		0.6	A
P_C	Collector dissipation	T_a=25°C	0.8	W
		T_C=25°C	4	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-a	Thermal resistance	Junction to ambient	187.5	°C/W
Rth-c		Junction to case	37.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

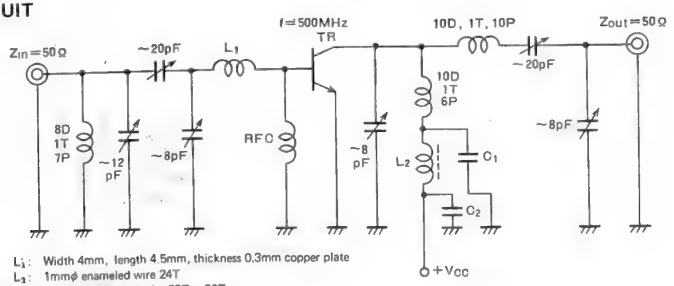
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=5mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	18			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.3W, f=500MHz	1.4	1.6		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

2SC2131

NPN EPITAXIAL PLANAR TYPE

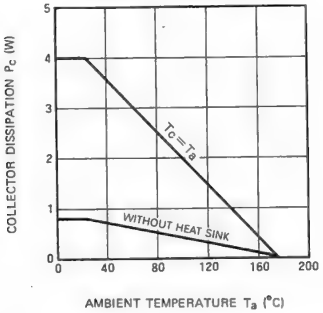
TEST CIRCUIT



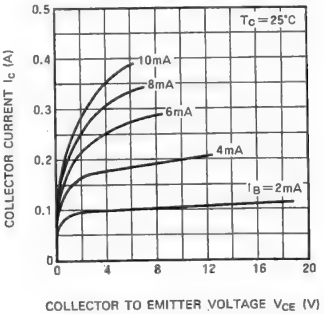
L_1: Width 4mm, length 4.5mm, thickness 0.3mm copper plate
L_2: 1mmφ enameled wire 2¼T
RFC: 0.3mmφ enameled wire 25T ~ 30T
C_1: 50pF, 100pF, 2200pF, 0.005μF, 0.0022μF in parallel
C_2: 0.02μF, 0.047μF, 0.47μF in parallel
Notes: Coils are made from 1.5mmφ silver plated copper wire except L_1, L_2 & RFC
D: Inner diameter of coil P: Pitch of coil
T: Turn number of coil Coil dimensions in milli-meter

TYPICAL PERFORMANCE DATA

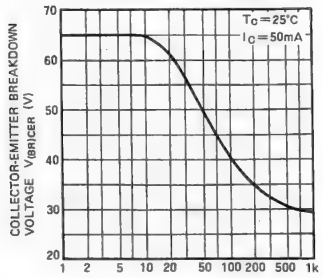
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



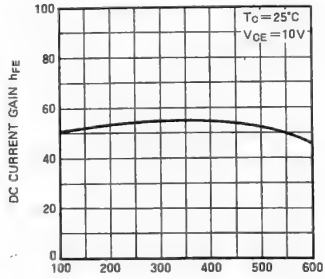
COLLECTOR CURRENT VS. BASE TO EMITTER VOLTAGE



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



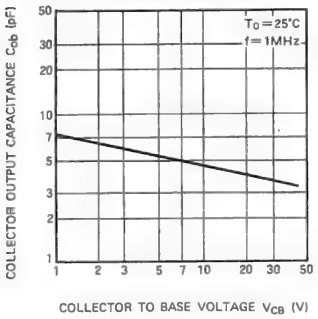
DC CURRENT GAIN VS. COLLECTOR CURRENT



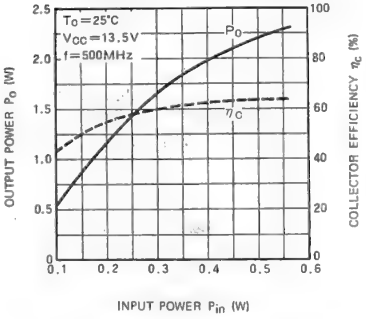
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

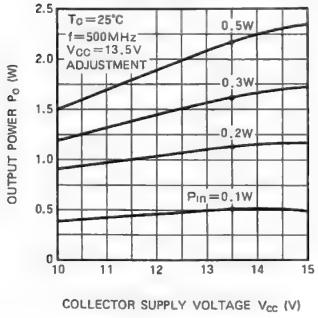
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



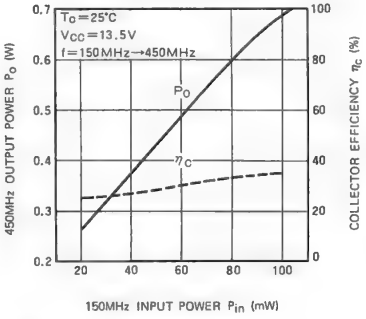
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



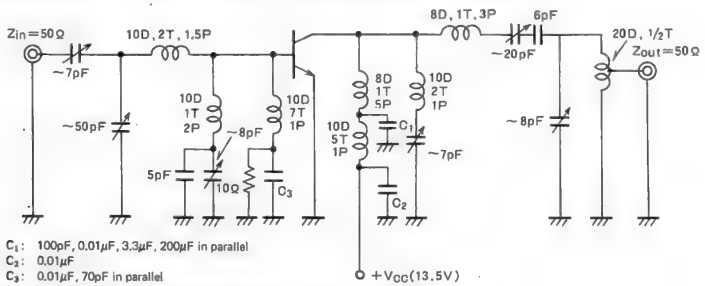
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



TRIPLER OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



APPLICATION CIRCUIT — TRIPLER CIRCUIT DIAGRAM (150MHz → 450MHz)



C_1: 100pF, 0.01μF, 3.3μF, 200μF in parallel
C_2: 0.01μF
C_3: 0.01μF, 70pF in parallel

Notes: All coils are made from 1.5mmφ silver plated copper wire
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

2SC2133

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2133 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in UHF band 24 to 28 volts operation applications.

FEATURES

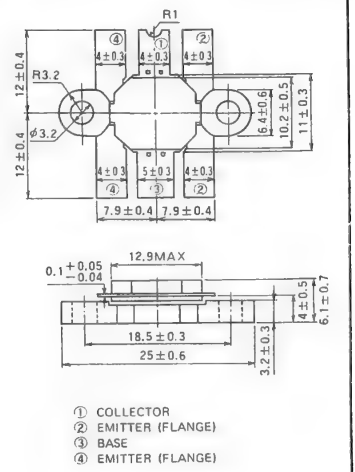
- High power gain: $G_{pe} \geqq 8.2$dB
  @V_{CC} = 28V, P_O = 30W, f = 220MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 28V, P_O = 30W, f = 220MHz, T_C = 25°C.
- Equivalent input series impedance: Z_{in} = 1.2 + j3.3Ω
  @V_{CC} = 28V, P_O = 30W, f = 220MHz

APPLICATION

10 to 15 watts output linear power amplifiers such as TV transposer amplifiers in VHF band.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		55	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	35	V
I_C	Collector current		5	A
P_C	Collector dissipation	T_a = 25°C	3.75	W
		T_C = 25°C	75	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55 ~ +175	°C
R_{th-a}	Thermal resistance	Junction to ambient	40	°C/W
R_{th-c}		Junction to case	2	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

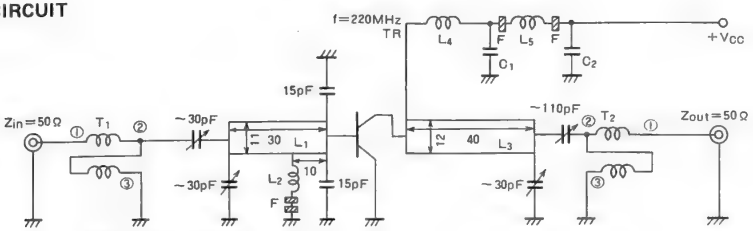
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	55			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, R_{BE}=∞	35			V
I_{CBO}	Collector cutoff current	V_{CB}=35V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1	mA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.2A	20	50	110	—
P_O	Output power	V_{CC}=28V, P_{in}=4.5W, f=220MHz	30	34		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

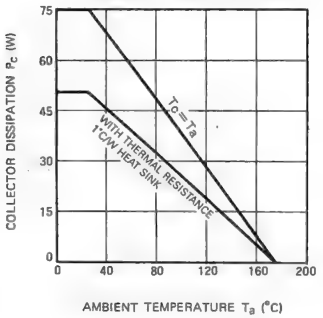


L_1, L_3: Thickness 0.2mm copper plate
L_2: 10D, 7T, 2P, φ1.0 silver plated copper wire
L_4: 12D, 3T, 3P, φ1.6 silver plated copper wire
L_5: 10D, 15T, φ1.0 enameled wire
T_1: 4:1 transformer
T_2: 1:4 transformer
F: Ferrite Sealed Bead
C_1: 330pF, 1000pF, 4700pF, 0.01μF, 0.1μF, 4.7μF in parallel
C_2: 330pF, 1000pF, 4700pF, 0.01μF, 0.1μF, 47μF in parallel

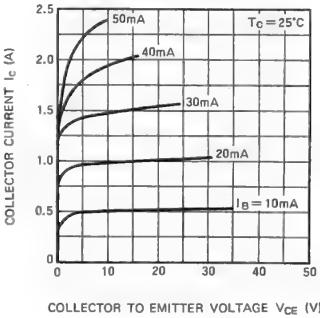
Note:
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

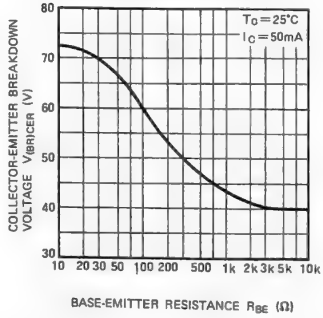
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



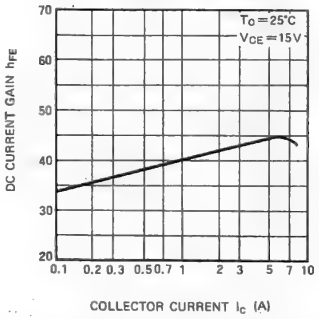
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

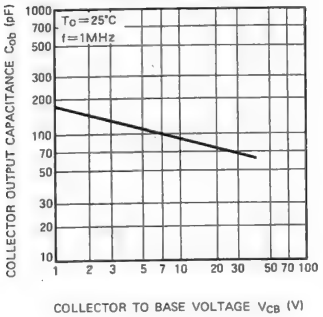


DC CURRENT GAIN VS. COLLECTOR CURRENT

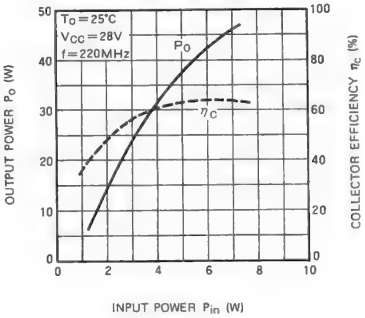


NPN EPITAXIAL PLANAR TYPE

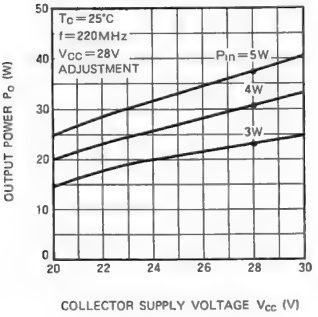
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



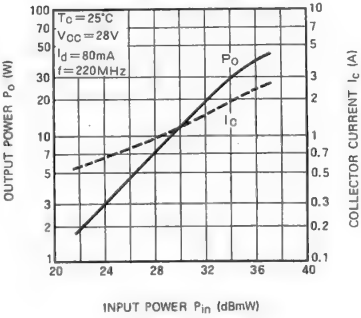
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



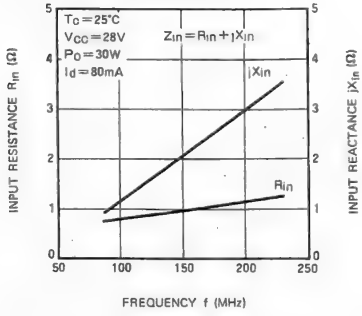
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



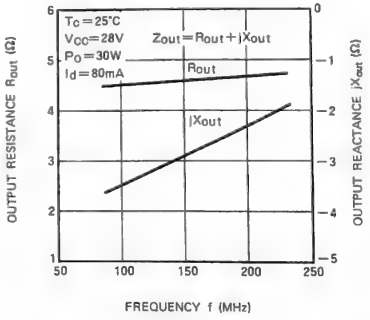
IN CASE AB OPERATING OUTPUT POWER COLLECTOR CURRENT VS. INPUT POWER



INPUT IMPEDANCE VS. FREQUENCY



OUTPUT IMPEDANCE VS. FREQUENCY



MITSUBISHI ELECTRIC

2SC2134

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2134 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band 24 to 28 volts operation applications.

FEATURES

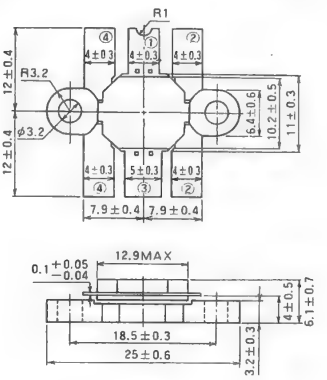
- High power gain: $G_{pe} \geqq 7dB$
  @V_{CC} = 28V, P_O = 60W, f = 220MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 28V, P_O = 50W, f = 220MHz, T_C = 25°C.
- Equivalent input series impedance: $Z_{in} = 1 + j3\Omega$
  @V_{CC} = 28V, P_O = 60W, f = 220MHz

APPLICATION

20 to 30 watts output linear power amplifiers such as TV transposer amplifiers in VHF band.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_O=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		55	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	35	V
I_C	Collector current		10	A
P_C	Collector dissipation	T_a=25°C	4	W
		T_C=25°C	120	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55~+175	°C
R_{th-a}	Thermal resistance	Junction to ambient	37.5	°C/W
R_{th-c}		Junction to case	1.25	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

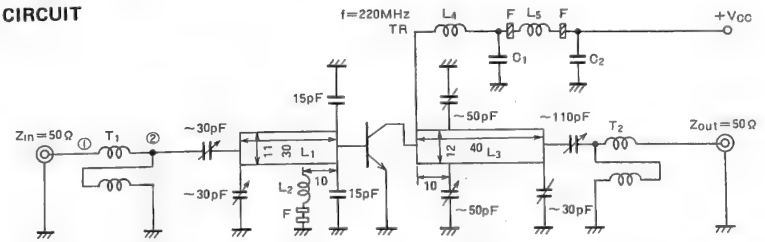
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=50mA, I_E=0	55			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	35			V
I_{CBO}	Collector cutoff current	V_{CB}=35V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			2	mA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.2A	20	50	110	—
P_O	Output power	V_{CC}=28V, P_{in}=12W, f=220MHz	60	70		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, Pw = 150μs, duty = 5%

2SC2134

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

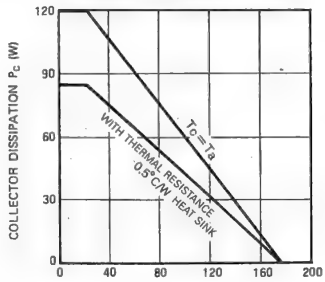


L_1, L_3: t = 0.2mm copper plate
L_2: 10D, 7T, 2P, ϕ1.0 silver plated copper wire
L_4: 12D, 3T, 3P, ϕ1.6 silver plated copper wire
L_5: 10D, 15T, ϕ1.0 enameled wire
T_1: 4:1 transformer
T_2: 1:4 transformer
F: Ferrite Bead
C_1: 330pF, 1000pF, 4700pF, 0.01μF, 0.1μF, 4.7μF in parallel
C_2: 330pF, 1000pF, 4700pF, 0.01μF, 0.1μF, 4.7μF in parallel

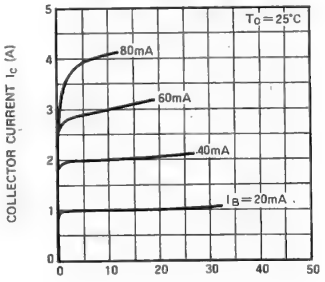
Notes. Coil
D: Inner diameter
P: Pitch
T: Turn number
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

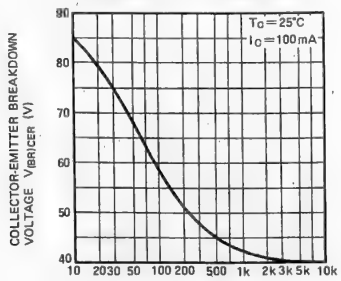
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



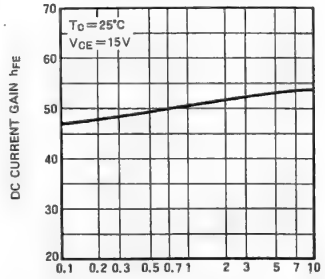
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BRREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



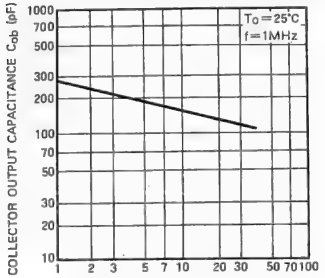
DC CURRENT GAIN VS. COLLECTOR CURRENT



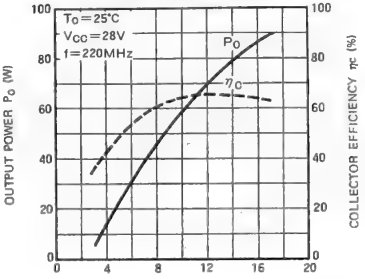
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

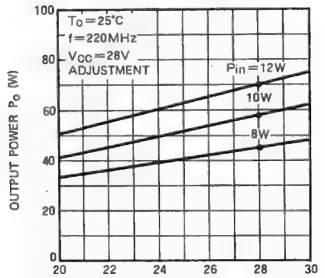
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



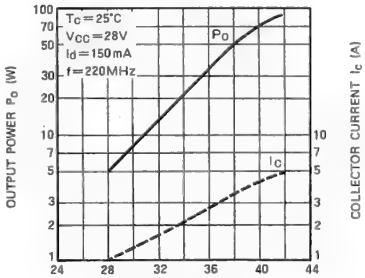
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



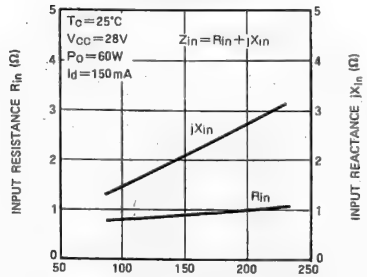
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



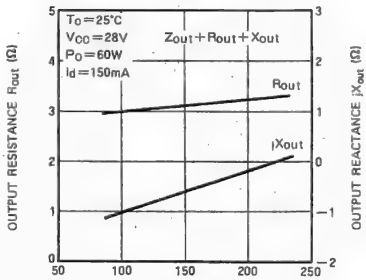
IN CASE AB OPERATING OUTPUT POWER, COLLECTOR CURRENT VS. INPUT POWER



INPUT IMPEDANCE VS. FREQUENCY



OUTPUT IMPEDANCE VS. FREQUENCY



2SC2166

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2166 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in HF band mobile radio applications.

FEATURES

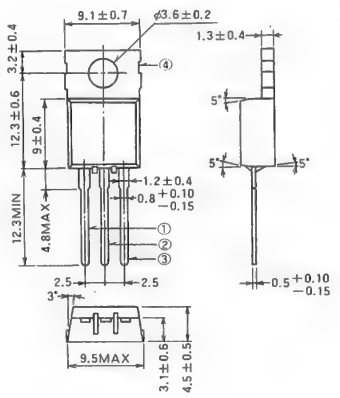
- High power gain: $G_{pe} \geqq 13.8dB$
  @V_{CC} = 12V, P_O = 6W, f = 27MHz
- Emitter ballasted construction for high reliability and good performances.
- TO-220 similar package is combinient for mounting.

APPLICATION

3 to 4 watts output power amplifiers in HF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① BASE
② COLLECTOR (FIN)
③ EMITTER
④ FIN (COLLECTOR)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		75	V
V_{EBO}	Emitter to base voltage		5	V
V_{CER}	Collector to emitter voltage	R_{BE}=10Ω	75	V
I_C	Collector current		4	A
P_C	Collector dissipation	T_a=25°C	1.5	W
		T_C=25°C	12.5	W
T_j	Junction temperature		+150	°C
T_{stg}	Storage temperature		−55～+150	°C
R_{th-a}	Thermal resistance	Junction to ambient	83	°C/W
R_{th-c}		Junction to case	10	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

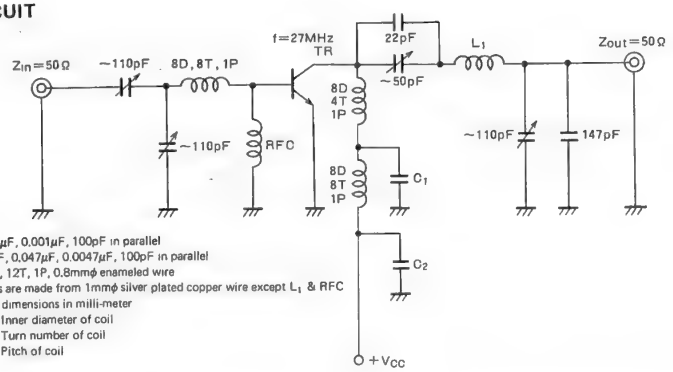
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	75			V
$V_{(BR)CER}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=10Ω	75			V
I_{CBO}	Collector cutoff current	V_{CB}=30V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	35	70	180	—
P_O	Output power	V_{CC}=12V, P_{in}=0.25W, f=27MHz	6	7.5		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty ≈ 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

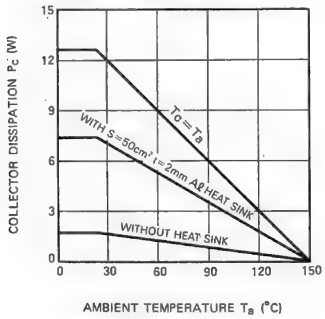
TEST CIRCUIT



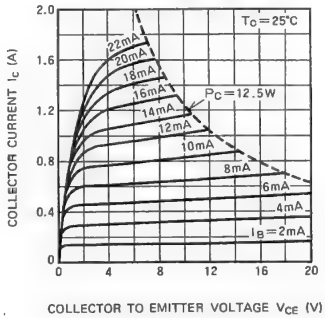
C_1: 0.01μF, 0.001μF, 100pF in parallel
C_2: 10μF, 0.047μF, 0.0047μF, 100pF in parallel
L_1: 10D, 12T, 1P, 0.8mmφ enameled wire
Notes: Coils are made from 1mmφ silver plated copper wire except L_1 & RFC
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

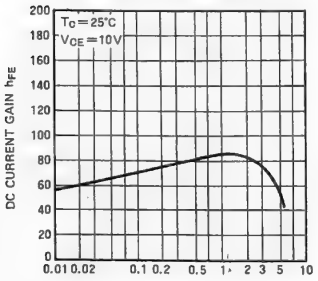
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



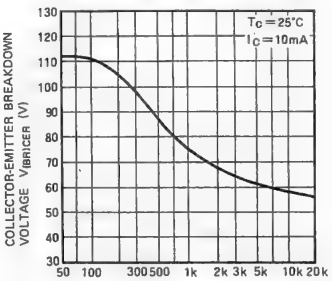
OUTPUT CHARACTERISTICS, COMMON EMITTER



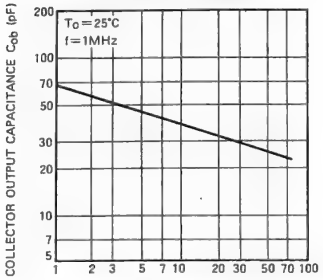
DC CURRENT GAIN VS. COLLECTOR CURRENT



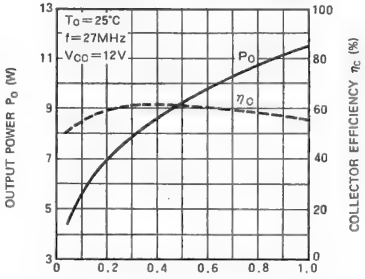
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



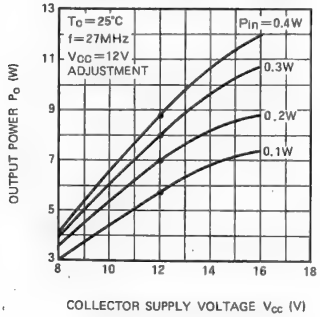
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2237

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2237 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

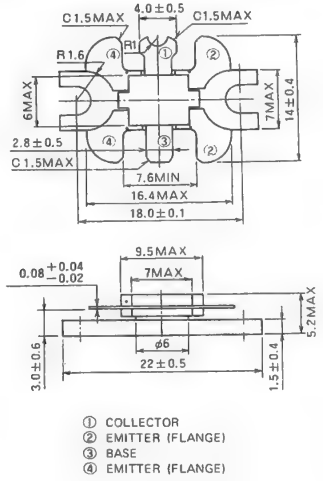
- High power gain: $G_{pe} \geqq 13.8$dB
  @V_{CC} = 13.5V, P_O = 6W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W, f = 175MHz.

APPLICATION

4 to 5 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	T_a=25°C	2	W
		T_C=25°C	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	75	°C/W
Rth-c		Junction to case	7.5	°C/W

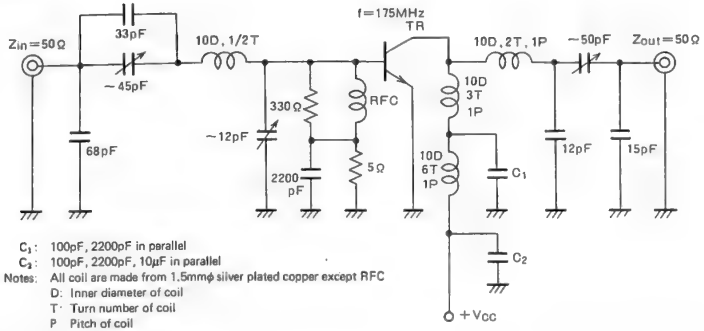
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.25W, f=175MHz	6	7.5		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

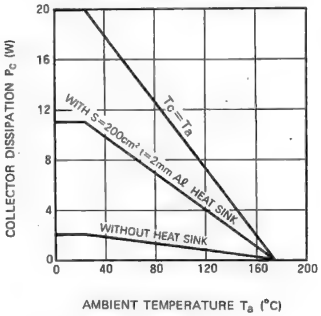
TEST CIRCUIT



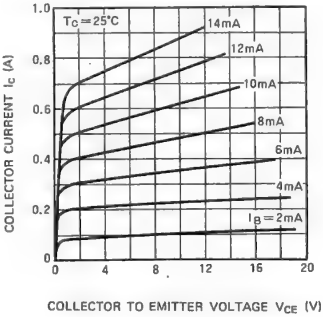
C_1: 100pF, 2200pF in parallel
C_2: 100pF, 2200pF, 10μF in parallel
Notes: All coil are made from 1.5mmφ silver plated copper except RFC
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

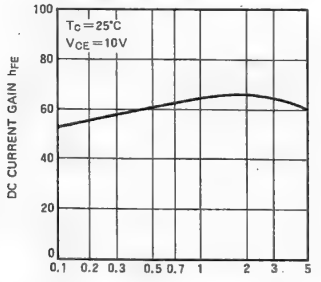
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



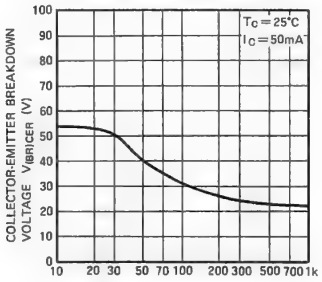
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



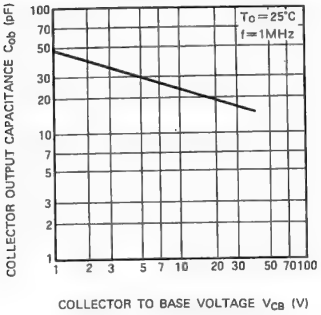
DC CURRENT GAIN VS. COLLECTOR CURRENT



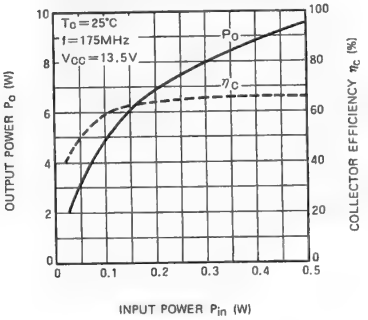
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

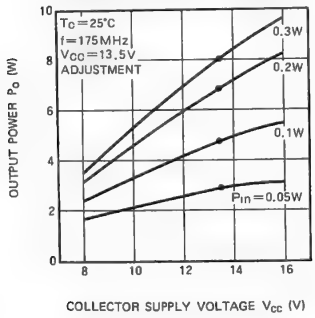
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2538

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2538 is a silicon NPN epitaxial planar type transistor designed for RF amplifiers on VHF band mobile radio applications.

FEATURES

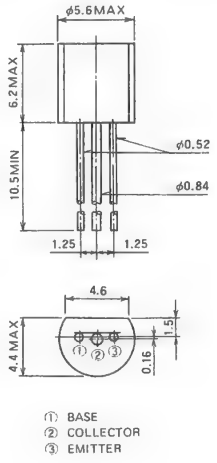
- High power gain: $G_{pe} \geqq 10dB$
  @V_{CC} = 13.5V, P_O = 0.5W, f = 175MHz
- TO-92 similar package is combinient for mounting.
- Equivalent input/output series impedance:
  Z_{in} = 5.3 – j2.9Ω @V_{CC} = 13.5V, P_O = 500mW, f = 175MHz
  Z_{out} = 29 – j63.5Ω

APPLICATION

Driver amplifiers in general VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① BASE
② COLLECTOR
③ EMITTER

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	17	V
I_O	Collector current		0.4	A
P_C	Collector dissipation	T_a = 25°C	0.7	W
		T_C = 25°C	3	W
T_j	Junction temperature		+135	°C
Tstg	Storage temperature		−55 ~ +135	°C
Rth-a	Thermal resistance	Junction to ambient	157	°C/W
Rth-c		Junction to case	36.7	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

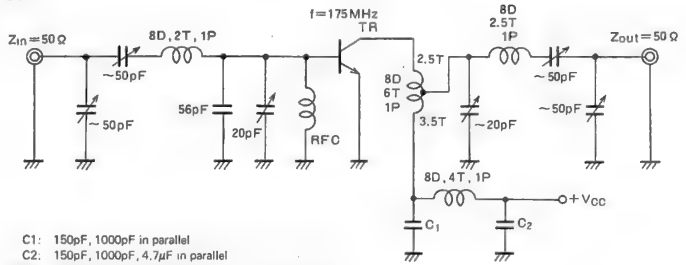
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 1mA, I_C = 0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 1mA, I_E = 0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 10mA, R_{BE} = ∞	17			V
I_{CBO}	Collector cutoff current	V_{CB} = 15V, I_E = 0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB} = 3V, I_C = 0			200	μA
h_{FE}	DC forward current gain*	V_{CE} = 10V, I_C = 0.1A	10	80	300	—
P_O	Output power	V_{CC} = 13.5V, P_{in} = 50mW, f = 175MHz	500	600		mW
η_C	Collector efficiency		45	55		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

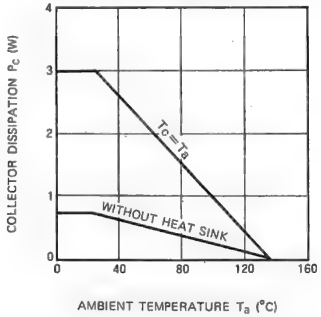
TEST CIRCUIT



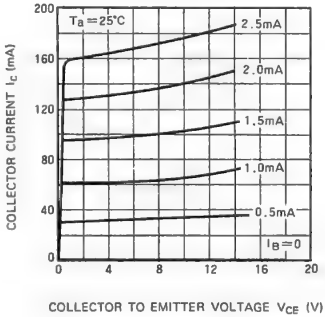
C1: 150pF, 1000pF in parallel
C2: 150pF, 1000pF, 4.7μF in parallel
NOTES: All coils are made from 1.5mmϕ silver plated copper wire
Coil Dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

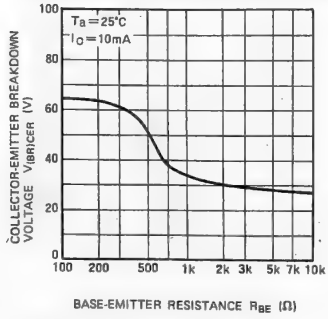
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



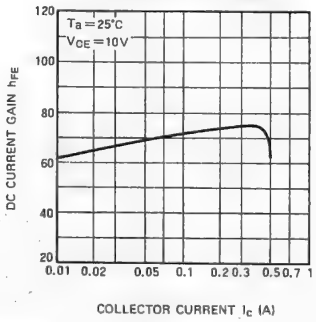
OUTPUT CHARACTERISTICS, COMMON EMITTER



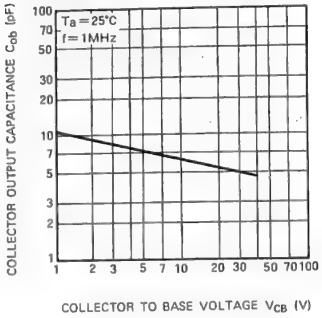
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



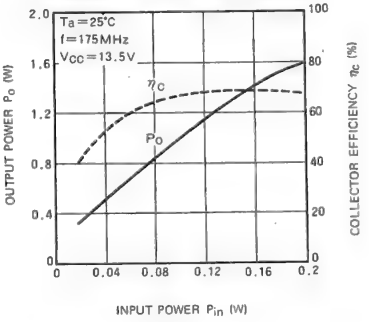
DC CURRENT GAIN VS. COLLECTOR CURRENT



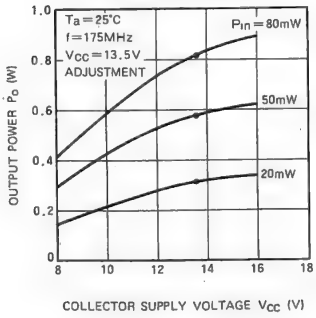
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2539

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2539 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

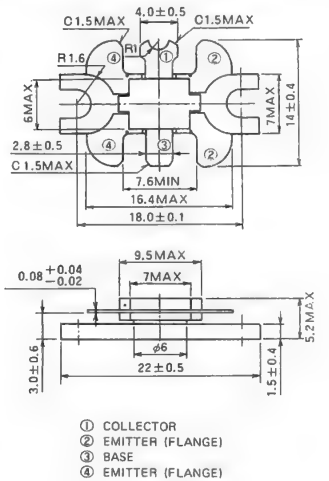
- High power gain: $G_{pe} \geqq 14.5$dB
  @V_{CC} = 13.5V, P_O = 14W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 18W, f = 175MHz, T_C = 25°C.

APPLICATION

10 to 14 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	17	V
I_C	Collector current		4	A
P_C	Collector dissipation	Ta=25°C	2.5	W
		T_C=25°C	35	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	60	°C/W
Rth-c		Junction to case	4.3	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

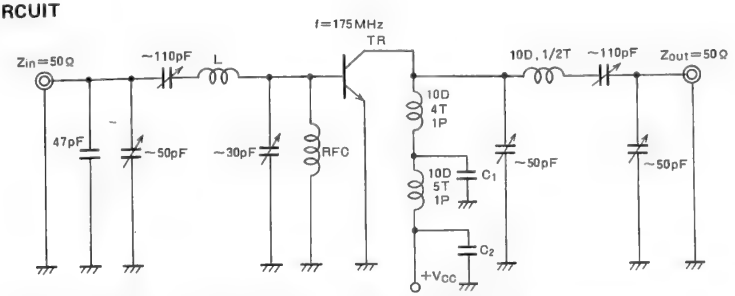
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, R_{BE} = ∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1000	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1000	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.5W, f=175MHz	14	17		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, P_W = 150μs, duty = 5%

2SC2539

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

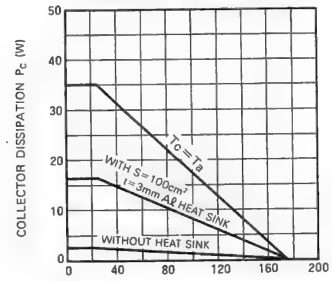


L: Length 10mm
RFC: 0.4mmφ enameled wire 12T with Ferrite Bead
C1 220pF, 2200pF in parallel
C2 220pF, 2200pF, 10μF in parallel

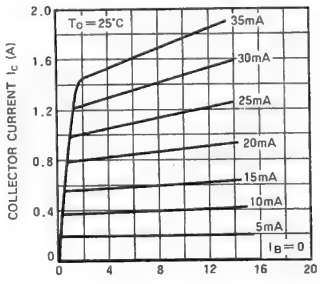
NOTES. All coils are made from 1.5mmφ silver plated copper wire
D Inner diameter of coil
T Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

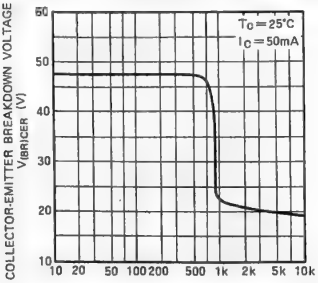
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



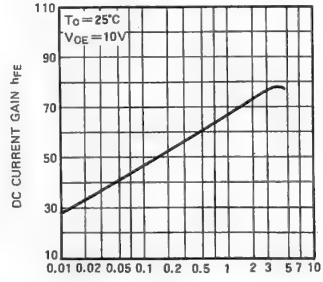
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

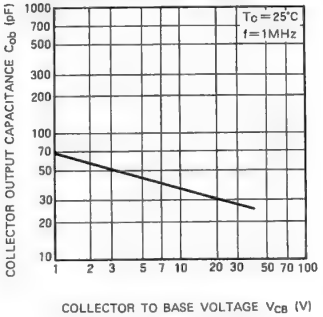


DC CURRENT GAIN VS. COLLECTOR CURRENT

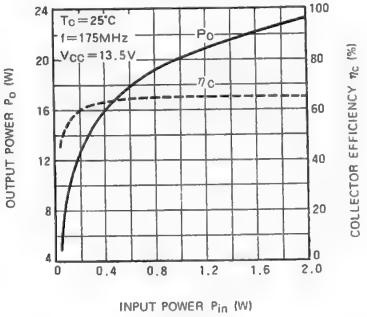


MITSUBISHI ELECTRIC

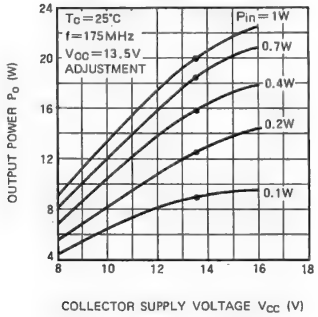
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2540

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2540 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

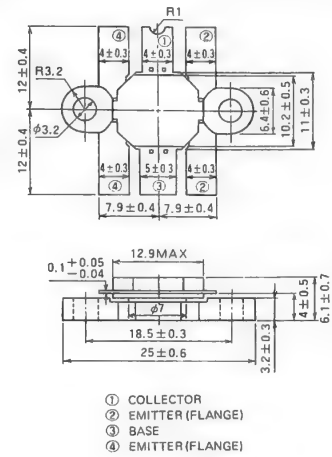
- High power gain: $G_{pe} \geqq 8.2$dB
  @V_{CC} = 13.5V, P_O = 40W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 40W, f = 175MHz, T_C = 25°C.

APPLICATION

30 to 35 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		10	A
P_C	Collector dissipation	T_a=25°C	4.5	W
		T_C=25°C	75	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	33.3	°C/W
Rth-c		Junction to case	2	°C/W

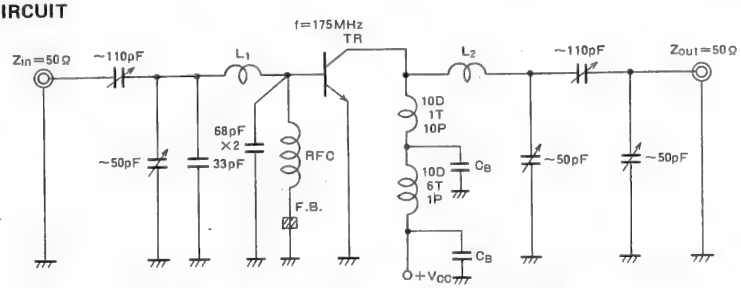
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			2.5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			2	mA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.2A	10	60	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=6W, f=175MHz	40	45		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

TEST CIRCUIT

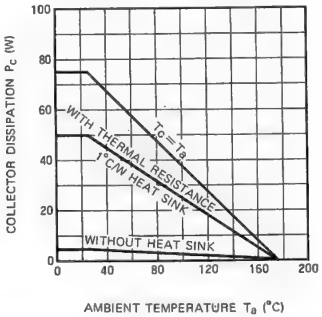


L1: Length = 10mm, width = 6mm, thickness = 0.3mm copper plate
L2: Length = 10mm, width = 3mm, thickness = 0.3mm copper plate
F.B.: Ferrite bead
RFC: 0.4mmϕ enameled copper wire 17 turn
C_B: 10μF, 1000pF, 150pF in parallel

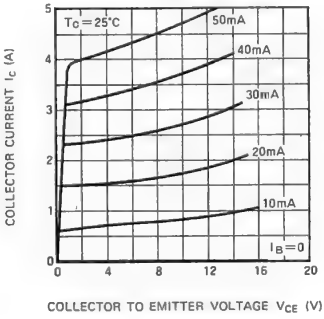
NOTES. Coils are made from 1.5mmϕ silver plated copper wire except L1 & L2
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

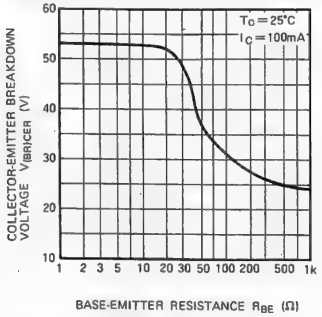
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



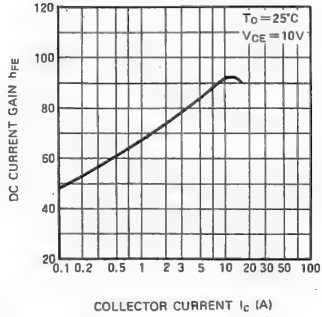
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

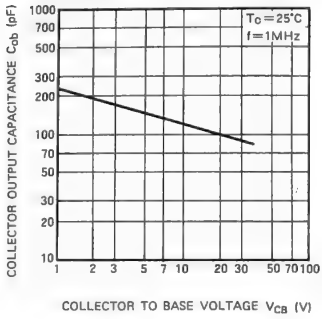


DC CURRENT GAIN VS. COLLECTOR CURRENT

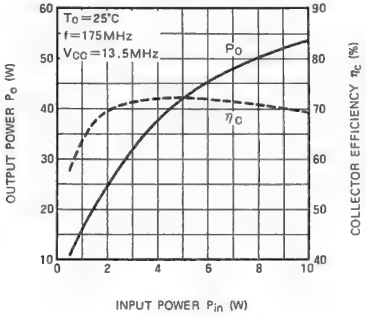


NPN EPITAXIAL PLANAR TYPE

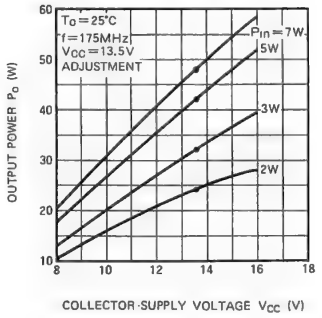
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2609

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

Mitsubishi 2SC2609 is a silicon NPN epitaxial planar type transistor specifically deisgned for VHF power amplifier applications.

FEATURES

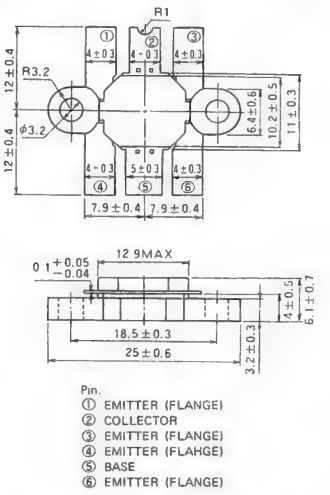
- High power gain: $G_{PB} \geqq 6.0$dB
  @V_{CC} = 28V, P_O = 100W, f = 220MHz
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 28V, f = 220MHz, P_O = 70W

APPLICATION

For output stage of 100W power amplifiers VHF band.

OUTLINE DRAWING

Dimensions in mm



Pin.
① EMITTER (FLANGE)
② COLLECTOR
③ EMITTER (FLANGE)
④ EMITTER (FLAHGE)
⑤ BASE
⑥ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_O=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		55	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	35	V
I_C	Collector current		15	A
P_C	Collector dissipation	T_C=25°C	170	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C

ELECTRICAL CHARACTERISTICS (T_O=25°C unless otherwise specified)

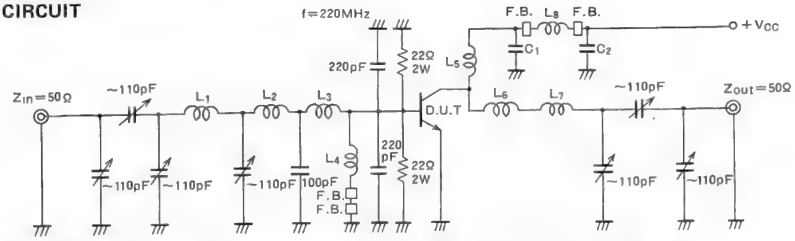
Symbol	Parameter	Test conditions	Limits			Unit
			Max	Typ	Min	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=100mA, I_E=0	55			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=200mA, $R_{BE}=\infty$	35			V
I_{CBO}	Collector cut off current	V_{BE}=35V, I_E=0			10	mA
I_{EBO}	Emitter cut off current	V_{EB}=3V, I_C=0			4	mA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.2A	20	50	110	—
P_O	Power output	V_{CC}=28V, f=220MHz, P_{in}=25W	100	110		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_w = 150μs, duty = 5%.

2SC2609

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

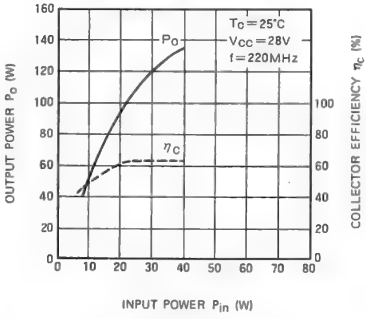


L_1 10D, 1T, ϕ1.6 Ag-plated Cu wire.
L_2 Length 10, ϕ1.6 Ag-plated Cu wire.
L_3 Length 15, ϕ1.6 Ag-plated Cu wire.
L_4 10D, 6T, 2P, ϕ1.6 Ag-plated Cu wire.
L_5 10D, 5T, 3P, ϕ1.6 Ag-plated Cu wire.
L_6 Length 20, Width 4, Thinkness 0.2 Cupper plate.
L_7 Length 27, ϕ1.6 Ag-plated Cu wire.
L_8 8D, 20T, 1P, ϕ0.8 Enameled wire.

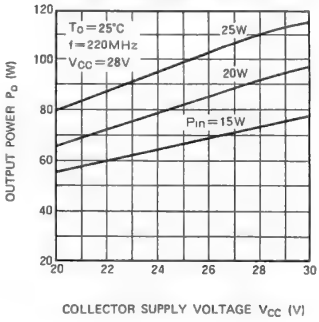
C_1 1000pF, 3300pF, 0.1μF, 4.7μF, in parallel.
C_2 1000pF, 3300μF, 0.1μF, 47μF, in parallel.
B.F Ferrint Bead
inside diameter 1.35
outside diameter 3.5.
length 3.0.
(Note) Dimensions mm
D : inner diameter of coil.
T : turn numbers of coil
P : pitch of coil

TYPICAL PERFORMANCE DATA

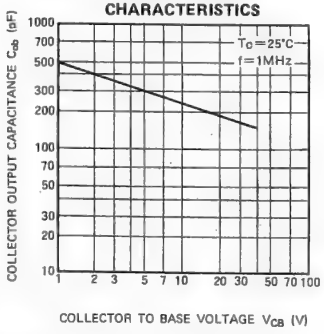
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



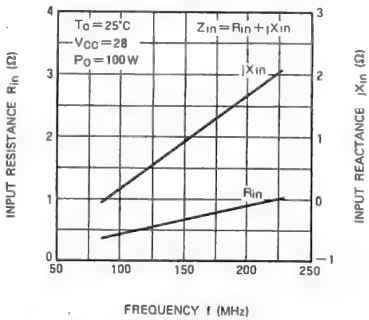
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



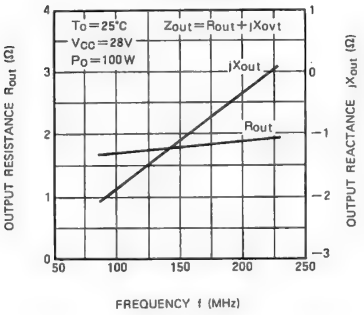
INPUT IMPEDANCE VS. FREQUENCY



MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

INPUT IMPEDANCE VS. FREQUENCY



2SC2627

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2627 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

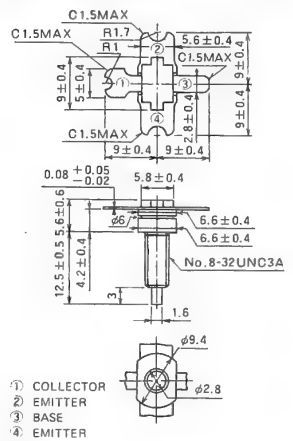
- High power gain: $G_{pe} \geqq 13$dB
  @V_{CC} = 12.5V, P_O = 5W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with stud.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W, f = 175MHz, T_C = 25°C.
- Equivalent input/output series impedance:
  Z_{in} = 2.9 + j0.5Ω @P_O = 6W, V_{CC} = 12.5V, f = 175MHz
  Z_{out} = 11 −j1.9Ω

APPLICATION

4 to 5 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



NOTE. ALL ELECTRODES ARE ISOLATED FROM STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	T_a=25°C	2	W
		T_C=25°C	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	75	°C/W
Rth-c		Junction to case	7.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

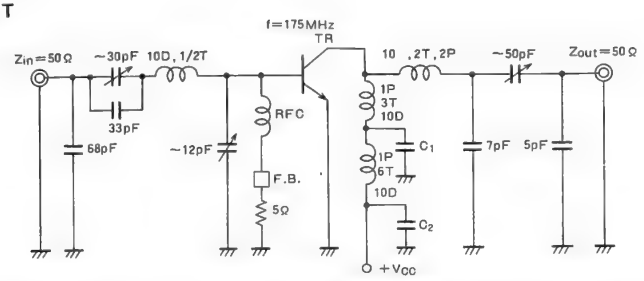
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	80	180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=0.25W, f=175MHz	5	6		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

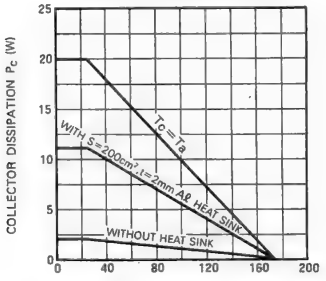


C1: 100pF, 2200pF, 0.01μF in parallel
C2. 100pF, 2200pF, 0.01μF, 10μF in parallel
F B. Ferrite Bead

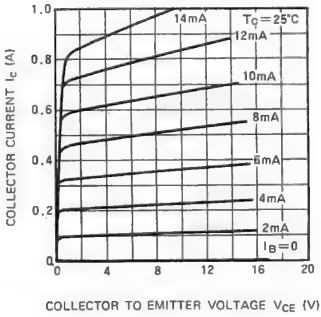
Notes. All coils are made from 1.5mmφ silver plated copper wire
D. Inner diameter of coil
T· Turn number of coil
P Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

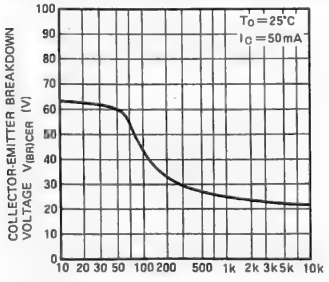
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



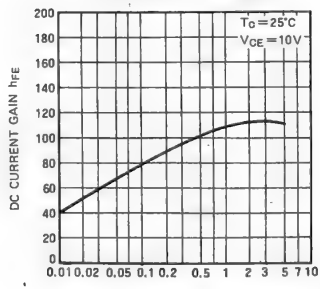
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

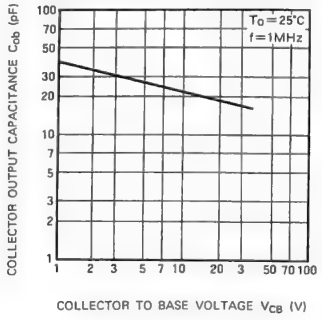


DC CURRENT GAIN VS. COLLECTOR CURRENT

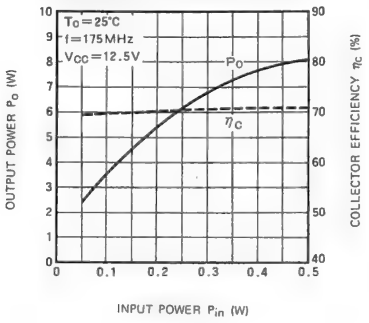


NPN EPITAXIAL PLANAR TYPE

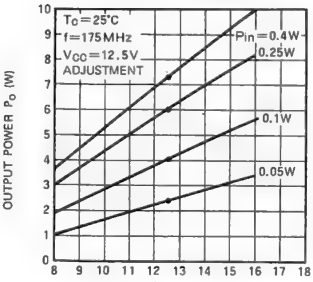
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2628

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2628 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

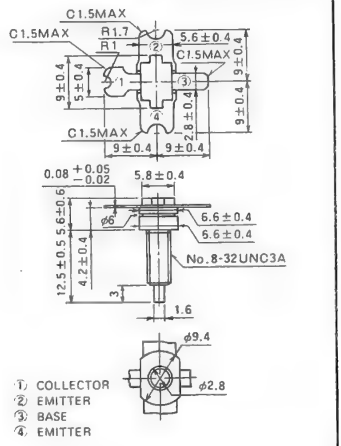
- High power gain: $G_{pe} \geqq 11.8$dB
  @V_{CC} = 12.5V, P_O = 15W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with stud.
- Ability of withstading more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 18W, f = 175MHz, T_C = 25°C.
- Equivalent input/output series impedance:
  Z_{in} = 2.0 + j0.4Ω @P_O = 18W, V_{CC} = 12.5V, f = 175MHz
  Z_{out} = 3.9 − j2.0Ω

APPLICATION

10 to 15 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



NOTE: ALL ELECTRODES ARE ISOLATED FROM STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

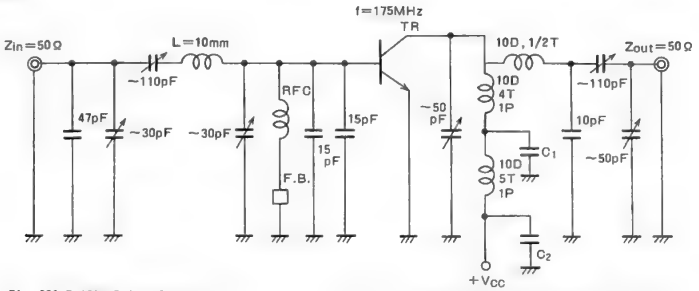
Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	17	V
I_C	Collector current		4	A
P_C	Collector dissipation	T_a=25°C	4	W
		T_C=25°C	40	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	37.5	°C/W
Rth-c		Junction to case	3.75	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, R_{BE} = ∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			2	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	30	180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=1W, f=175MHz	15	18		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

TEST CIRCUIT

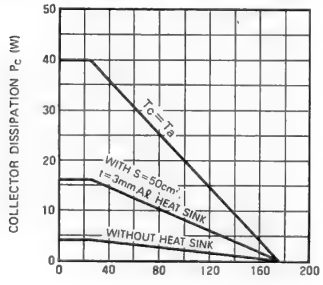


C1 220pF, 4700pF, 0.01μF in parallel
C2 220pF, 0.02μF, 0.1μF, 3.3μF in parallel
F.B. Ferrite Bead

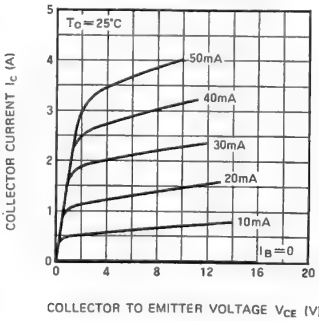
Notes All coils are made from 1.5mmφ silver plated copper wire
D Inner diameter of coil
T Turn number of coil
P Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

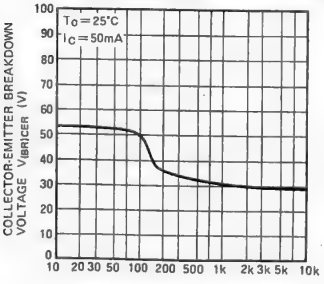
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



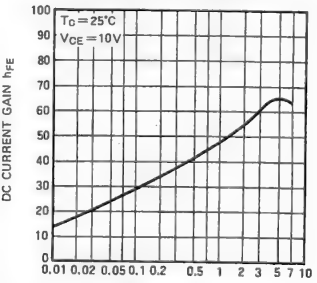
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



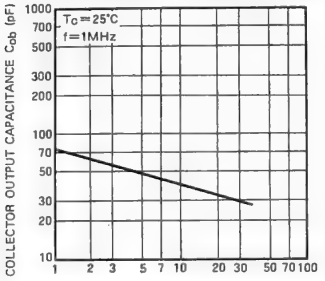
DC CURRENT GAIN VS. COLLECTOR CURRENT



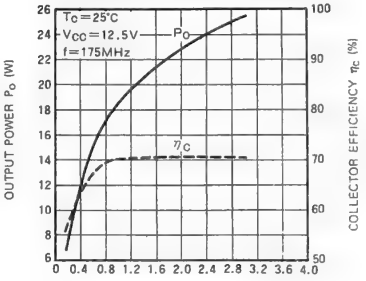
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

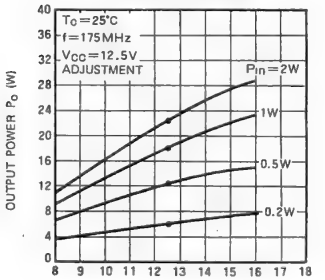
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2629

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2629 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

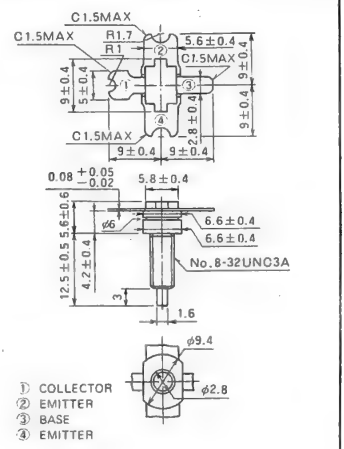
- High power gain: $G_{pe} \geqq 9.3$dB
  @V_{CC} = 12.5V, P_O = 30W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with stud.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 30W, f = 175MHz, T_C = 25°C.
- Equivalent input/output series impedance:
  Z_{in} = 1.8 + j0.5Ω @P_O = 34W, V_{CC} = 12.5V, f = 175MHz
  Z_{out} = 2.3 – j1.2Ω

APPLICATION

25 to 30 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



NOTE ALL ELECTRODES ARE ISOLATED FROM STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	17	V
I_C	Collector current		8	A
P_C	Collector dissipation	T_a=25°C	3	W
		T_C=25°C	60	
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	2.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

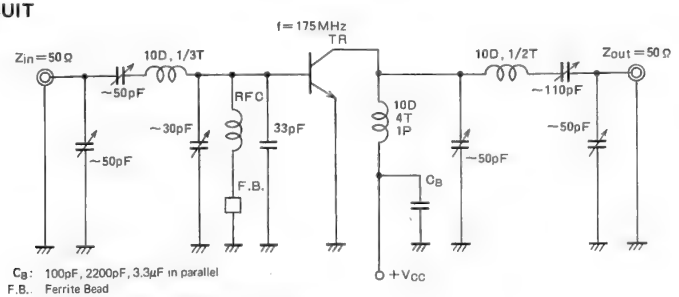
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			3	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			3	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.2A	10	40	180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=3.5W, f=175MHz	30	34		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

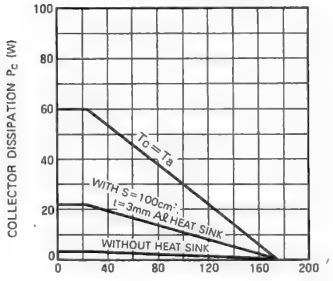
TEST CIRCUIT



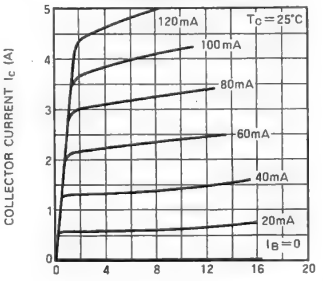
C_B: 100pF, 2200pF, 3.3μF in parallel
F.B.: Ferrite Bead
Notes: All coils are made from 1.5mmϕ silver plated copper wire
D Inner diameter of coil
T Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

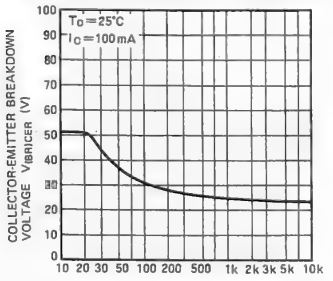
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



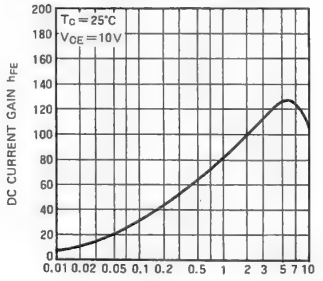
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

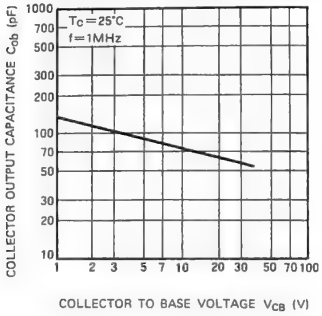


DC CURRENT GAIN VS. COLLECTOR CURRENT

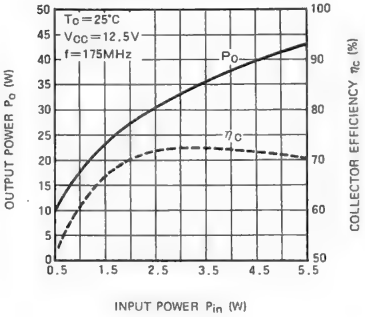


NPN EPITAXIAL PLANAR TYPE

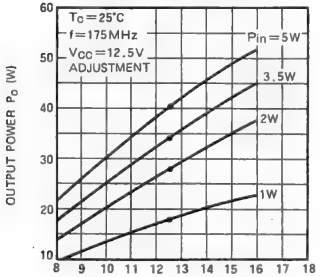
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2630

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2630 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

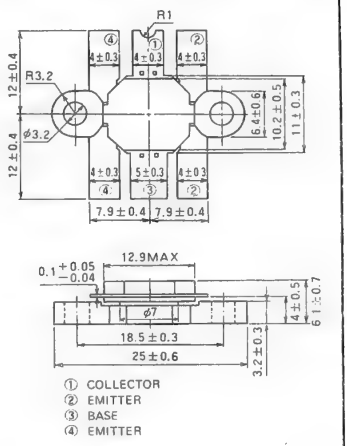
- High power gain: $G_{pe} \geqq 7dB$
  @V_{CC} = 12.5V, P_O = 50W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 50W, f = 175MHz, T_C = 25°C.
- Equivalent input/output series impedance:
  Z_{in} = 0.8 + j1.2Ω @P_O = 60W, V_{CC} = 12.5V, f = 175MHz
  Z_{out} = 1.5 – j0.6Ω

APPLICATION

40 to 60 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



NOTE. ALL ELECTRODES ARE ISOLATED FROM FLANGE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	17	V
I_C	Collector current		14	A
P_C	Collector dissipation	T_a=25°C	5.5	W
		T_C=25°C	100	
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 – +175	°C
Rth-a	Thermal resistance	Junction to ambient	27.2	°C/W
Rth-c		Junction to case	1.5	°C/W

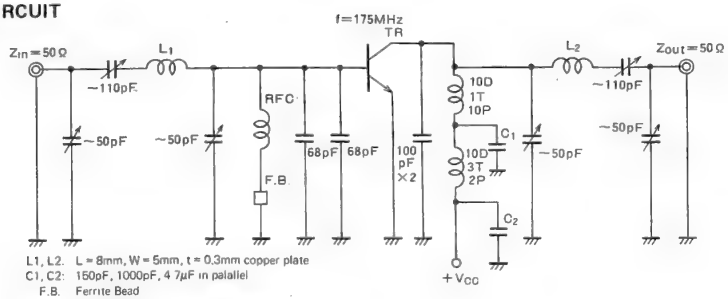
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			5	mA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.2A	10	40	180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=10W, f=175MHz	50	60		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

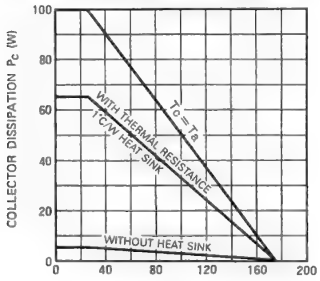
TEST CIRCUIT



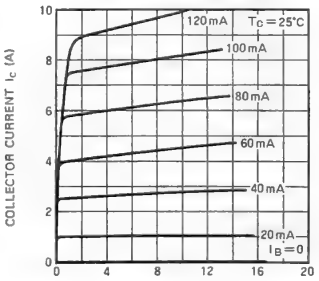
L1, L2. L = 8mm, W = 5mm, t = 0.3mm copper plate
C1, C2: 150pF, 1000pF, 4.7μF in paralliel
F.B. Ferrite Bead
NOTES All coils are made from 1.5mmϕ silver plated copper wire
D Inner diameter of coil
T Turn number of coil
P Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

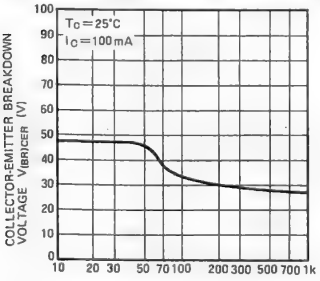
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



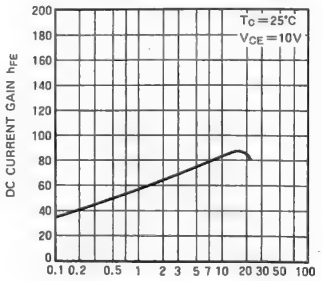
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



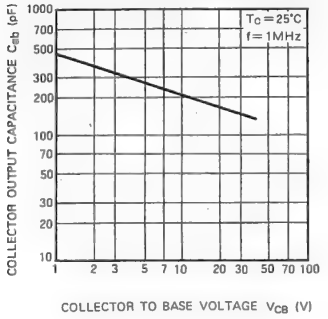
DC CURRENT GAIN VS. COLLECTOR CURRENT



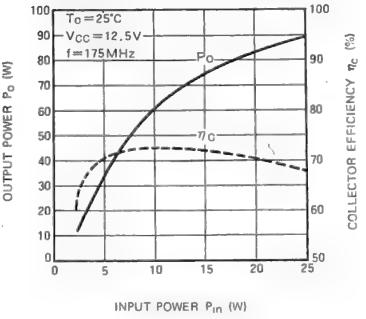
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

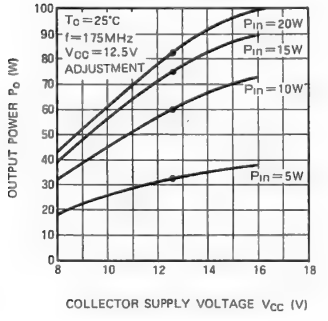
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2694

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2694 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

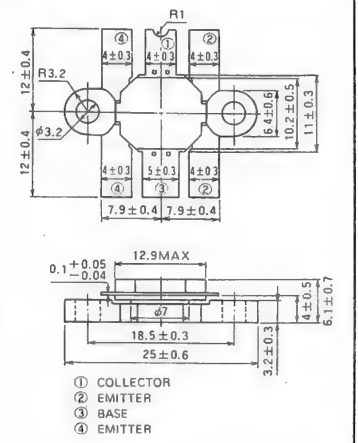
- High power gain: $G_{pe} \geqq 6.7$dB
  @V_{CC} = 12.5V, P_O = 70W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 70W, f = 175MHz, T_C = 25°C.
- Equivalent input/output series impedance:
  Z_{in} = 0.7 + j0.9Ω @P_O = 70W, V_{CC} = 12.5V, f = 175MHz
  Z_{out} = 1.2 – j0.3Ω

APPLICATION

50 to 60 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



NOTE: ALL ELECTRODES ARE ISOLATED FROM FLANGE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	17	V
I_C	Collector current		20	A
P_C	Collector dissipation	T_a=25°C	5.5	W
		T_C=25°C	140	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	27.2	°C/W
Rth-c		Junction to case	1.07	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=20mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=20mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			5	mA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=1A	10	50	180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=15W, f=175MHz	70	75		W
η_C	Collector efficiency		60	70		%

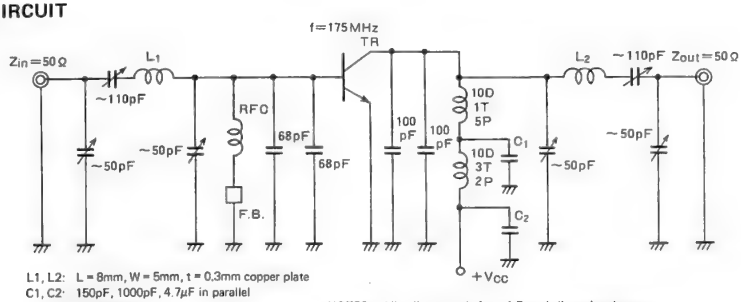
* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

2SC2694

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

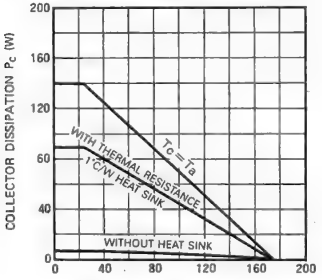


L1, L2: L = 8mm, W = 5mm, t = 0.3mm copper plate
C1, C2: 150pF, 1000pF, 4.7μF in parallel
F.B.: Ferrite Bead

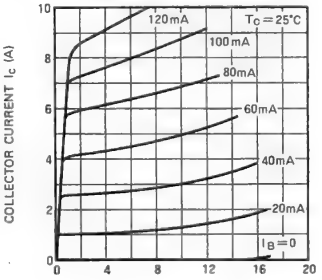
NOTES. All coils are made from 1 5mmϕ silver plated copper wire
D: Inner diameter of coil
T: Turn number of coil
P Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

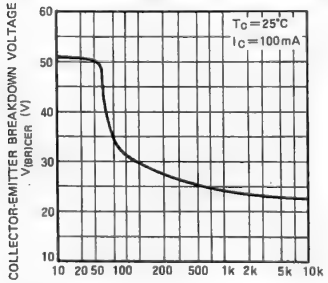
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



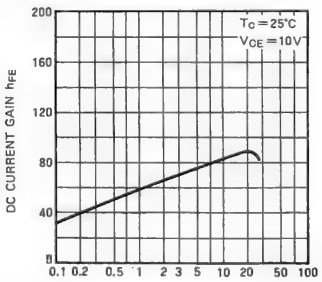
OUTPUT CHARACTERISTICS, COMMON EMITTER



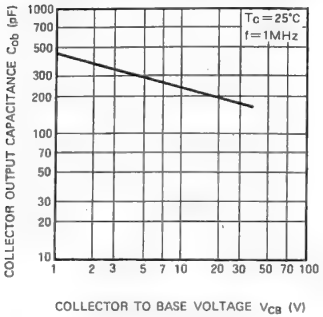
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



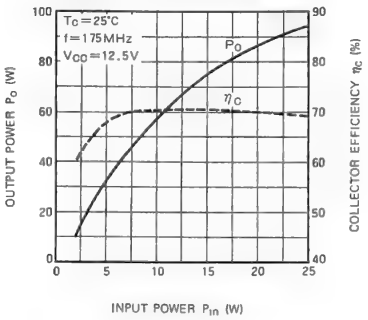
DC CURRENT GAIN VS. COLLECTOR CURRENT



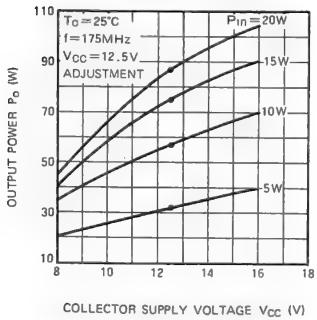
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2695

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2695 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in UHF band mobile radio applications.

FEATURES

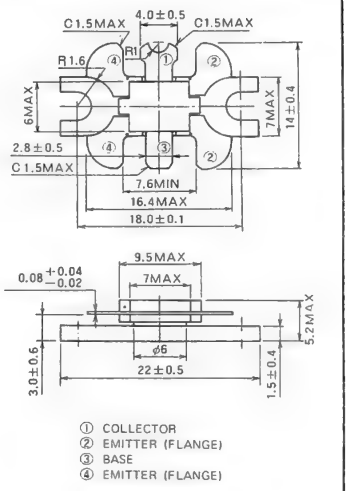
- High power gain: $G_{pe} \geqq 4.9$dB
  @V_{CC} = 13.5V, P_{in} = 9W, f = 520MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR all phase when operated at V_{CC} = 15.2V, P_O = 30W, f = 520MHz.
- Series equivalent input/output impedance:
  Z_{in} = 1.5 + j2Ω @P_O = 30W, V_{CC} = 13.5V, f = 520 MHz
  Z_{out} = 2.5 + j1Ω

APPLICATION

25 to 28 watts output power amplifiers in UHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	17	V
I_C	Collector current		10	A
P_C	Collector dissipation	T_a = 25°C	3	W
		T_C = 25°C	75	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	2	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

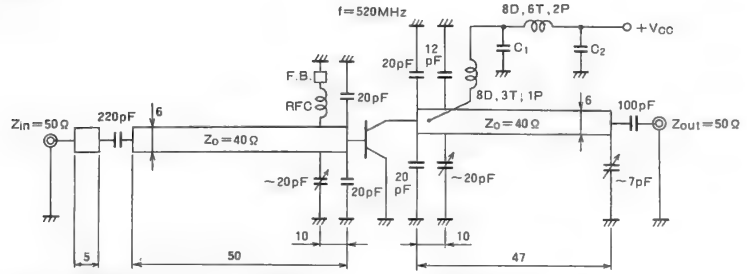
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE} = ∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			3	mA
h_{FE}	DC forward current gain *	V_{CC}=10V, I_C=1A	20	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=9W, f=520MHz	28	32		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

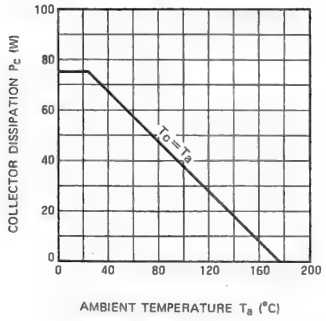


RFC. 0.4mmφ enameled wire 8T on D = 4mm, L = 13mm Bakelite
F.B.. Ferrite bead
C1: 68pF, 3300pF, 4700pF, 33μF in parallel
C2: 3300pF, 4700pF, 33μF in parallel

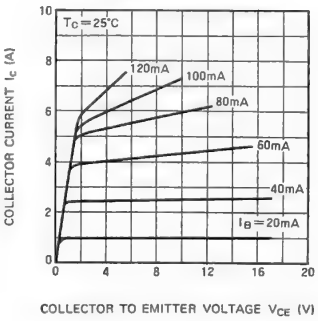
NOTES Coil dimensions in milli-meter
D Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Material of microstrip line H = 1.6mm Teflon glass (ϵ_s = 2.7)

TYPICAL PERFORMANCE DATA

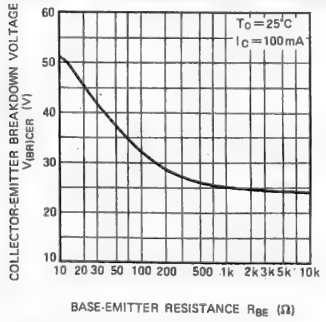
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



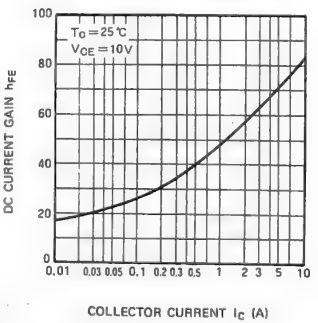
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



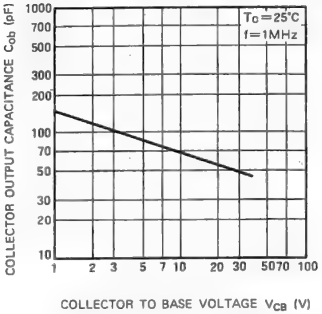
DC CURRENT GAIN VS. COLLECTOR CURRENT



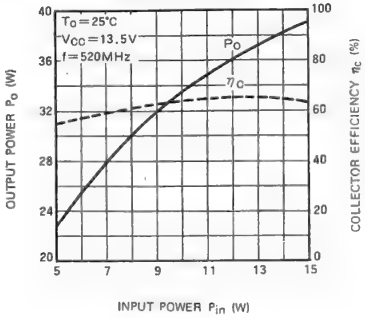
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

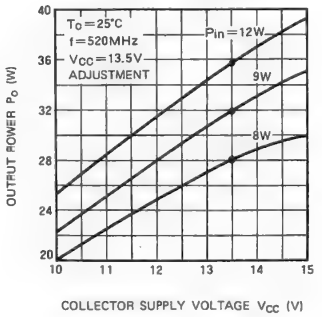
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2797

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2797 is a silicon NPN epitaxial planar type transistor designed for RF broad-band power amplifiers in UHF band.

FEATURES

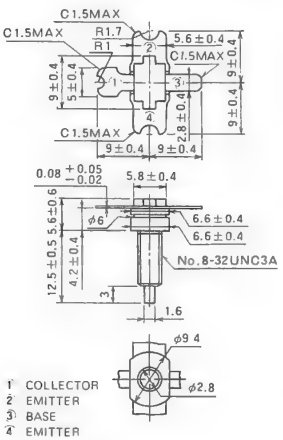
- High power gain: $G_{pe} \geqq 7$dB (Class AB)
  @V_{CC} = 24V, P_O = 5W, f = 770MHz, I_D = 20mA
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with stud.
- Ability of withstanding load VSWR 8.8:1 when operated at V_{CC} = 24V, P_O = 5W, f = 175MHz, T_C = 25°C, class AB condition.

APPLICATION

UHF high voltage (24V) broad-band amplifiers

OUTLINE DRAWING

Dimensions in mm



NOTE ALL ELECTRODES ARE ISOLATED FROM STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		45	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	35	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_a=25°C	1	W
		T_C=25°C	10	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-c	Thermal resistance	Junction to case	15	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_B=0	45			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, R_{BE}=∞	35			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			400	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			200	μA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=24V, P_{in}=1W,	5	6		W
η_C	Collector efficiency	f=770MHz, I_D=20mA **	55	60		%

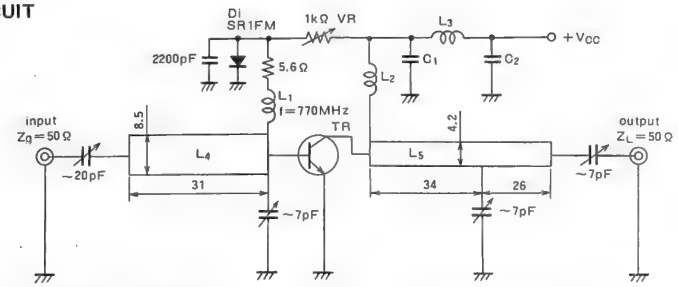
* Note: Pulse test; P_W = 150μs, duty = 5% ** Note: Class AB operation

MITSUBISHI ELECTRIC

2SC2797

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

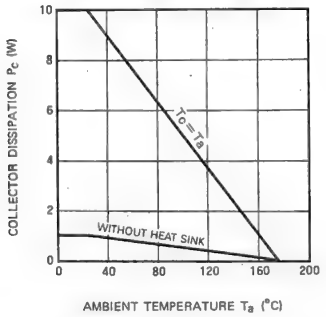


L1: 0.4mmφ enameled wire 6T, 3P
L2: Width 3mm, length 25mm, thickness 0.15mm copper plate
L3: 0.4mmφ enameled 21T
C1: 100pF, 1000pF, 0.01μF, 1μF in parallel
C2: 100pF, 1000pF, 0.1μF, 10μF in parallel
L4,L5: Microstrip line (t = 1.6mm, ϵ_s = 2.7 Teflon)

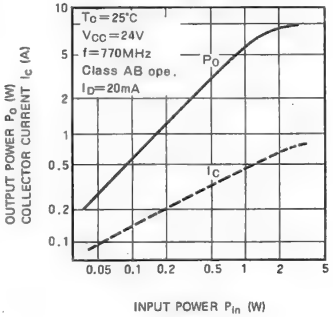
NOTES: Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

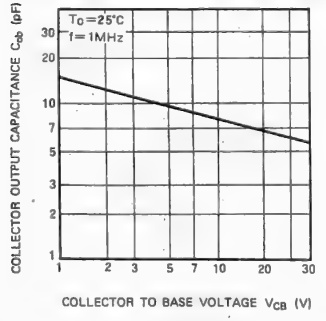
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



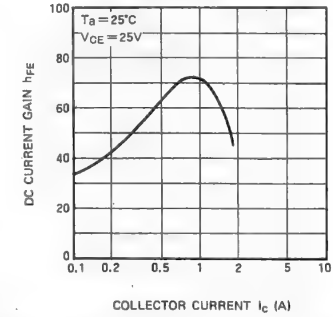
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



DC CURRENT GAIN VS. COLLECTOR CURRENT



2SC2798

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2798 is a silicon NPN epitaxial planar type transistor designed for RF broad-band power amplifiers in UHF band.

FEATURES

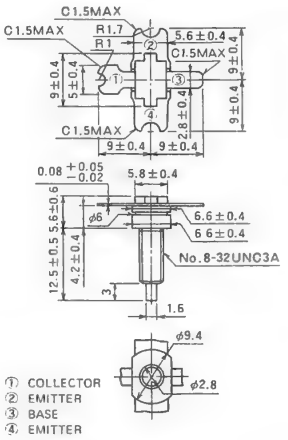
- High power gain: $G_{pe} \geqq 6$dB (Class AB)
  @V_{CC} = 24V, P_O = 12W, f = 770MHz, I_D = 50mA
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with stud.
- Ability of withstanding load VSWR 8.8:1 when operated at V_{CC} = 24V, P_O = 12W, f = 175MHz, I_D = 50mA, T_C = 25°C, class AB condition.

APPLICATION

UHF high voltage (24V) broad-band amplifiers

OUTLINE DRAWING

Dimensions in mm



NOTE. ALL ELECTRODES ARE ISOLATED FROM STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		45	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	35	V
I_C	Collector current		2	A
P_C	Collector dissipation	T_C=25°C	30	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-c	Thermal resistance	Junction to case	5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

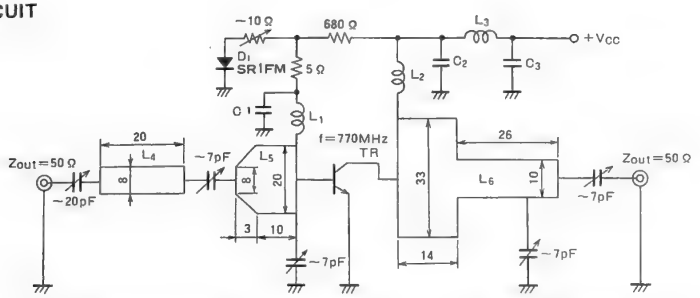
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	45			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, R_{BE} = ∞	35			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1000	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			400	μA
h_{FE}	DC forward current gain*	V_{CE}=25V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=24V, P_{in}=3W, f=770MHz, I_D=50mA**	12	14		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5% ** Note: Class AB operation.

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

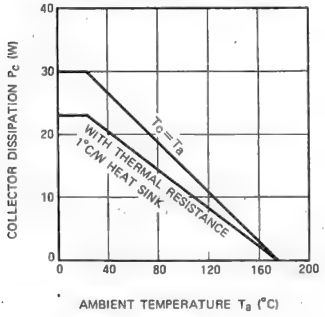


L1: 4D, 6T, 3P, 0.4mmφ enameled wire
L2: Width = 3mm, thickness = 0.15mm, length = 23mm copper plate
L3: 4D, 20T, 1P, 0.4mmφ enameled wire
L4~L6: Microstrip line (t = 1.6mm, ϵ_s = 2.7 Teflon)

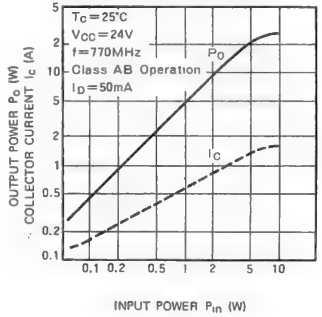
C1: 1000pF, 0.01μF in parallel
C2: 100pF, 1000pF, 0.01μF, 1μF in parallel
C3: 100pF, 1000pF, 0.1μF, 10μF in parallel
NOTES: Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

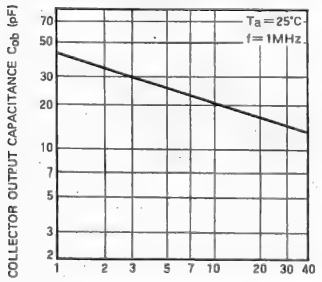
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



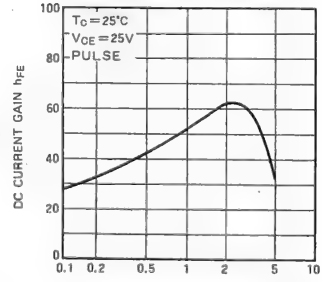
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



DC CURRENT GAIN VS. COLLECTOR CURRENT



2SC2799

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

MITSUBISHI 2SC2799 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifier applications.

FEATURES

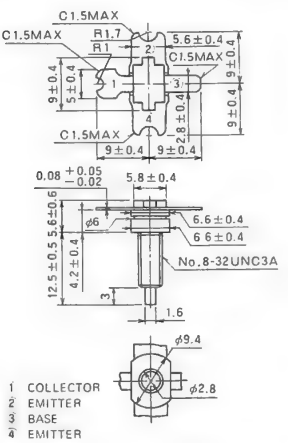
- High power gain: $G_{pe} \geqq 4.9$dB (Class AB)
  @V_{CC} = 24V, P_O=25W, f=770MHz, I_D = 80mA
- Ability to withstanding load VSWR 8.8:1 when operated at V_{CC} = 24V, P_O = 25W, f = 770MHz, I_D = 80mA, class AB condition.

APPLICATION

UHF high voltage (24V) broad-band amplifiers

OUTLINE DRAWING

Dimensions in mm



NOTE: EMITTER ELECTRODES ARE CONNECTED WITH STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		45	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	35	V
I_C	Collector current		4	A
P_C	Collector dissipation	T_C=25°C	50	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55∼+175	°C
Rth-c	Thermal resistance	Junction to case	3	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	45			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	35			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1.5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0V			500	μA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.2A	10	50	180	—
P_O	Output power	V_{CC}=24V, f=770MHz, P_{in}=8W, I_D=80mA **	25	27		W
η_C	Collector efficiency		55	60		%

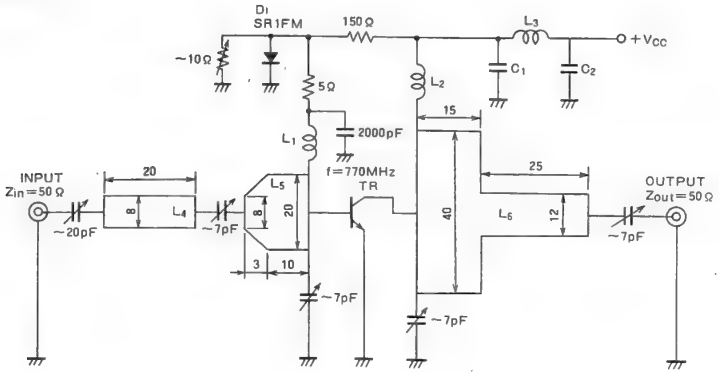
* Note: Pulse test, P_W = 150μs, duty 5% ** Note: Class AB operation

MITSUBISHI ELECTRIC

2SC2799

NPN EPITAXIAL PLANAR TYPE

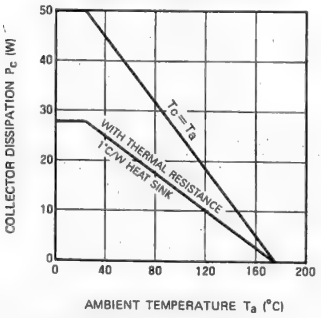
TEST CIRCUIT



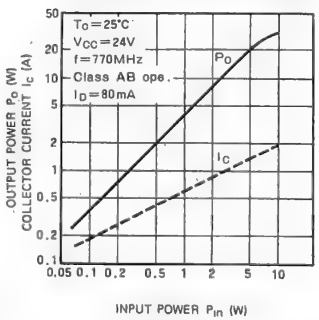
L1: 0.4mmϕ enameled wire 6T, 2P.
L2: Width = 3mm, thickness = 0.15mm, lenght = 25mm, copper plate.
L3: 0.4mmϕ enameled wire 20T, 1P.
C1: 100pF, 1000pF, 0.01μF, 1μF, in parallel.
C2: 100pF, 1000pF, 0.1μF, 10μF, in parallel
L4~L6: Microstrip line: t = 1.6mm, teflon ϵ_s = 2.7
NOTES D: Inner diameter of coil.
T: Turn numbers of coil.
P: Pitch of coil.
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

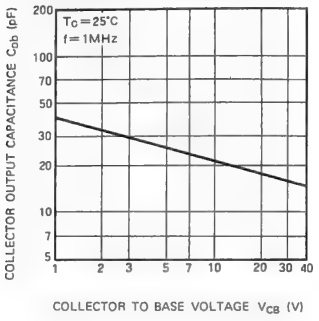
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



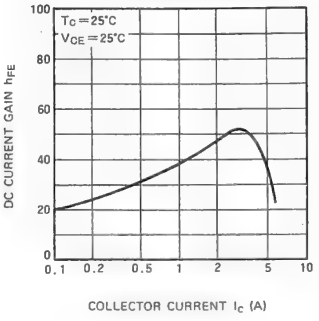
OUTPUT POWER, COLLECTOR CURRENT VS. INPUT POWER



COLLECTOR OUTPUT CAPACITANCE VS.
COLLECTOR TO BASE VOLTAGE



DC CURRENT GAIN VS.
COLLECTOR CURRENT



MITSUBISHI ELECTRIC

2SC2904

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC2904 is a silicon NPN epitaxial planar type transistor specifically designed for high power amplifiers in HF band.

FEATURES

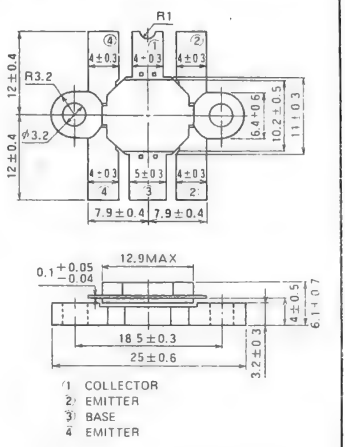
- High gain: $G_{pe} \geqq 11.5$dB
  @V_{CC} = 12.5V, P_O = 100W, f = 30MHz
- High ruggedness: Ability to withstand 20:1 load VSWR when operated at f = 30MHz
  P_O = 100W, V_{CC} = 15.2V
- Emitter ballansted construction
- Low thermal resistance ceramic package with flange.

APPLICATION

Output stage of transmitter in HF band SSB mobile radio sets.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		5	V
V_{CER}	Collector to emitter voltage	R_{BE} = ∞	20	V
I_C	Collector current		22	A
P_C	Collector dissipation	T_a = 25°C	7.8	W
		T_C = 25°C	200	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-c	Thermal resistance		0.75	°C/W

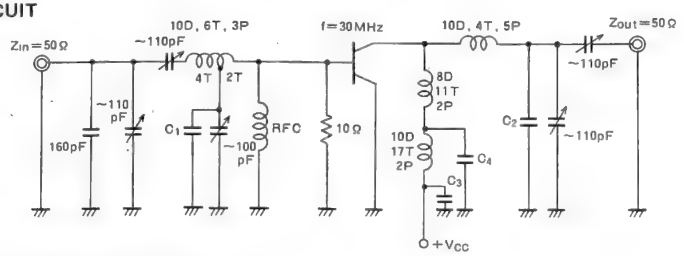
ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 20mA, I_C = 0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 20mA, I_E = 0	50			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 100mA, R_{BE} = ∞	20			V
I_{CBO}	Collector cutoff current	V_{CB} = 15V, I_E = 0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB} = 3V, I_C = 0			5	mA
h_{FE}	DC forward current gain*	V_{CE} = 10V, I_C = 1A	10	50	180	—
P_O	Output power	f = 30MHz, V_{CC} = 12.5V, P_{in} = 7W	100	110		W
η_C	Collector efficiency		55	60		%

* Note. Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

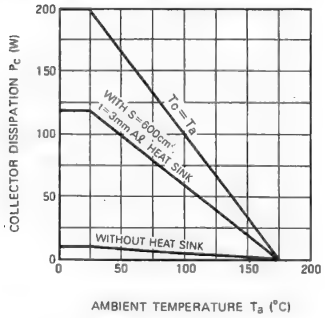
TEST CIRCUIT



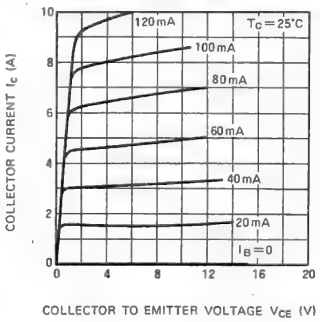
C_1 160pF, 160pF, 82pF in parallel
C_2 82pF, 82pF, 82pF in parallel
C_3 100pF, 4700pF, 4700pF, 0.22μF, 0.22μF, 33μF, 330μF in parallel
C_4 100pF, 220pF, 4700pF, 0.1μF, 330μF in parallel
NOTES: All coils but L_1 are made from 1.5φmm silver plated copper wire, L_1 is made from 2.3φmm copper wire.
D: Inner diameter of coil P: Pitch of coil
T: Turn number of coil Dimension is milli-meter

TYPICAL PERFORMANCE DATE

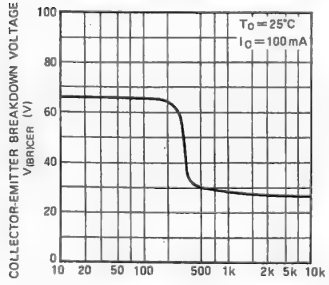
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



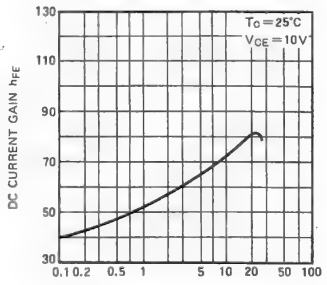
COLLECTOR CURRENT VS. COLLECTOR TO EMITTER VOLTAGE



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

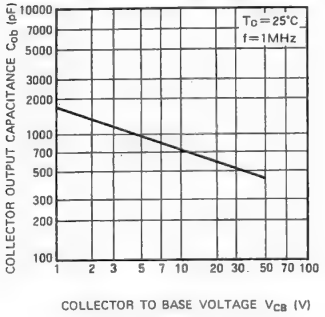


DC CURRENT GAIN VS. COLLECTOR CURRENT

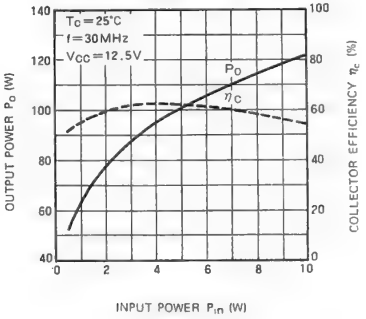


MITSUBISHI ELECTRIC

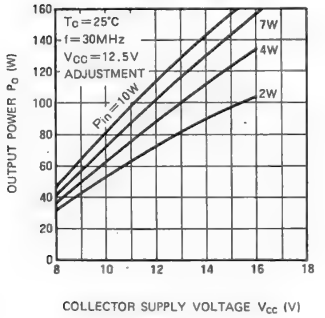
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2905

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2905 is a silicon NPN epitaxial planar type transistor specifically designed for high power amplifiers applications in UHF band.

FEATURES

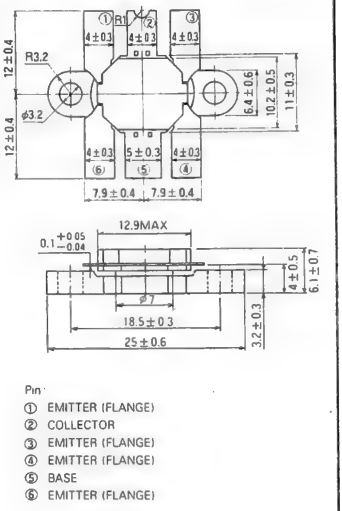
- High power output, high gain:
  $P_O \geqq 45W$, $G_{pe} \geqq 4.8dB$ @$V_{CC} = 12.5V$, $f = 520MHz$, $P_{in} = 15W$.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC} = 15.2V$, $P_O = 45W$, $f = 520MHz$.
- High reliability due to gold metalization die.
- Flange type ceramic package.
- $\dot{Z}_{in} = 1.2 + j1.1\Omega$, $\dot{Z}_{out} = 1.3 + j1.0\Omega$ @$V_{CC} = 12.5V$, $f = 520MHz$, $P_O = 45W$.

APPLICATION

For output stage of 35 – 40W power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



Pin
① EMITTER (FLANGE)
② COLLECTOR
③ EMITTER (FLANGE)
④ EMITTER (FLANGE)
⑤ BASE
⑥ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS ($T_C = 25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		15	A
P_C	Collector dissipation	$T_C = 25°C$	120	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 – +175	°C

ELECTRICAL CHARACTERISTICS ($T_C = 25°C$)

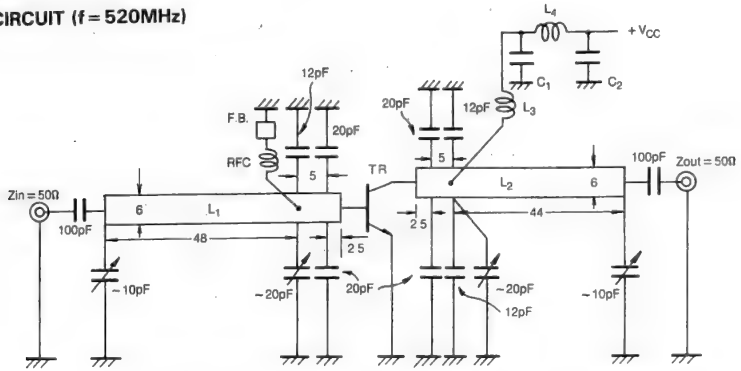
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E = 10mA$, $I_C = 0$	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C = 10mA$, $I_E = 0$	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C = 0.1A$, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cut off current	$V_{CB} = 15V$, $I_E = 0$			2	mA
I_{EBO}	Emitter cut off current	$V_{EB} = 3V$, $I_C = 0$			3	mA
h_{FE}	DC forward current gain *	$V_{CE} = 10V$, $I_C = 1A$	10	50	180	—
P_O	Power Output	$V_{CC} = 12.5V$, $P_{in} = 15W$, $f = 520MHz$	45	50		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, $P_W = 150\mu s$, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

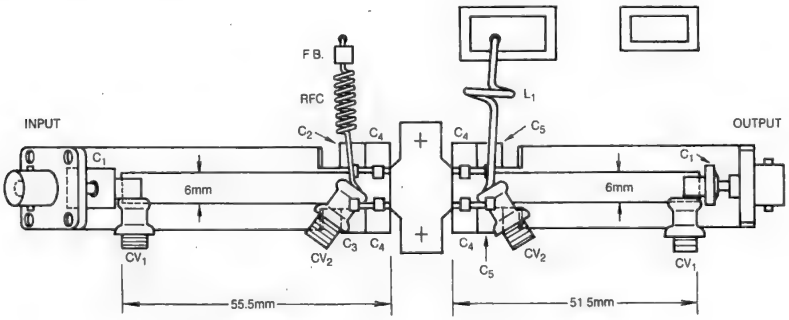
TEST CIRCUIT (f = 520MHz)



Dimensions: mm

L_1, L_2: Microstrip. Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_3: 1 Turn, AWG #13, 8mm I.D
L_4: 5 Turns, AWG #13, 8mm I.D
RFC: 9 Turns, AWG #20, 4mm I.D.
F.B.: Ferrite Bead
C_1: 82pF, 220pF, 2200pF, 4700pF, 33μF in Parallel
C_2: 82pF, 220pF, 2200pF, 4700pF, 22μF in Parallel

TEST CIRCUIT BOARD LAYOUT (f = 520MHz)



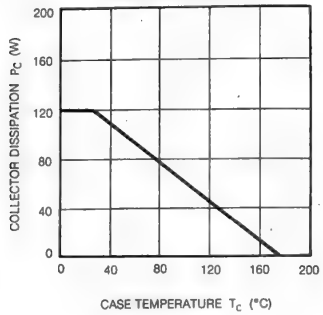
C_1: 100pF(Ribbon Lead Mica)
C_2: 12pF(Ribbon Lead Mica)
C_3: 0
C_4: 20pF(Ribbon Lead Mica)
C_5: 12pF(Ribbon Lead Mica)
CV_1: ~10pF(Air Variable Capacitor) muRata TTA 43 A 100A
CV_2: ~20pF(Air Variable Capacitor) muRata TTA 45 A 200A
F.B.: Ferrite Bead
RFC: 9 Turns, AWG #20, 4mm I.D.
L_1: 1 Turns, AWG #13, 8mm I.D.
Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon r = 2.7$

2SC2905

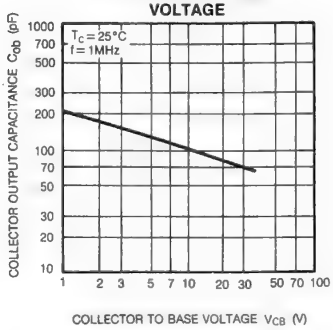
NPN EPITAXIAL PLANAR TYPE

TYPICAL PERFORMANCE DATA

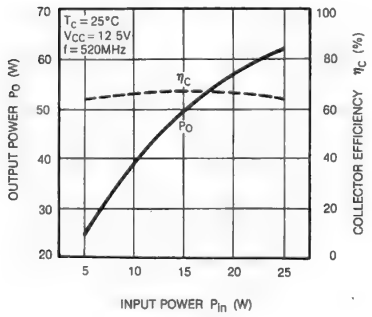
COLLECTOR DISSIPATION VS. CASE TEMPERATURE



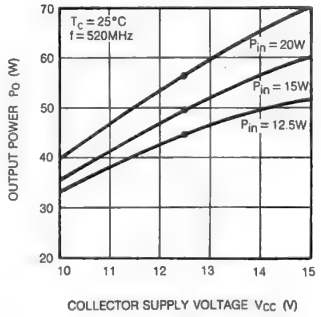
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



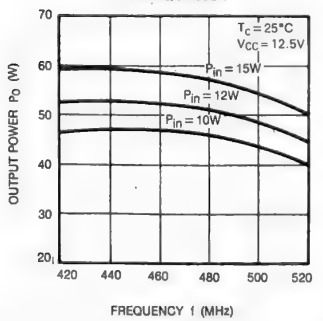
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



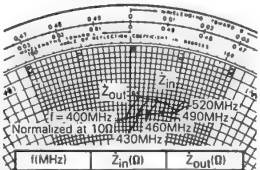
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



OUTPUT POWER VS. FREQUENCY



SERIES INPUT AND OUTPUT IMPEDANCE VS. FREQUENCY CHARACTERISTICS



f(MHz)	$\dot{Z}_{in}(\Omega)$	$\dot{Z}_{out}(\Omega)$
400	1.02+j0.20	1.50−j0.1
430	1.03+j0.40	1.45+j0.19
460	1.05+j0.60	1.40+j0.45
490	1.08+j0.85	1.35+j0.74
520	1.20+j1.10	1.30+j1.00

Conditions:
P_O = 45W, T_C = 25°C, V_{CC} = 12.5V

MITSUBISHI ELECTRIC

2SC2932

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2932 is a silicon NPN epitaxial planar type transistor specifically designed for power amplifiers applications in 800~940 MHz UHF band.

FEATURES

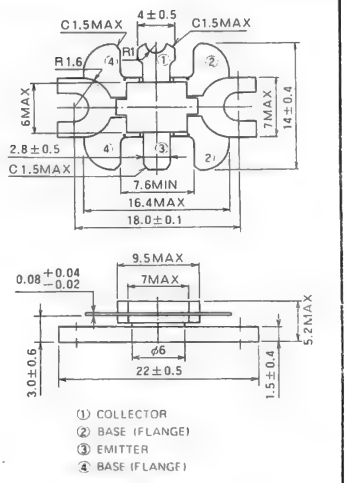
- High power gain: $G_P \geqq 7.8$dB, $P_O \geqq 6$W
  @ f = 900MHz, V_{CC} = 12.5V
- Emitter ballasted construction
- Gold metalization die in the transistor
- High ruggedness high reliability: Ability to withstand 20:1 load VSWR when operated at V_{CC}=15.2V, P_O=6W, f=900MHz.
- Small size, low common lead inductance strip line type ceramic package.
- Common base configuration.
- Series equivalent input/output impedance
  Z_{in} = 2.8–j1.4 (Ω), Z_{out} = 4.7–j5.9 (Ω)
  Operated at f = 900MHz, V_{CC} = 12.5V, P_O = 6W

APPLICATION

RF power amplifiers applications in 800 to 940 MHz mobile radio sets.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		3	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	17	V
I_C	Collector current		2	A
P_O	Collector dissipation	T_C=25°C	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-c	Thermal resistance	Junction to case	7.5	°C/W

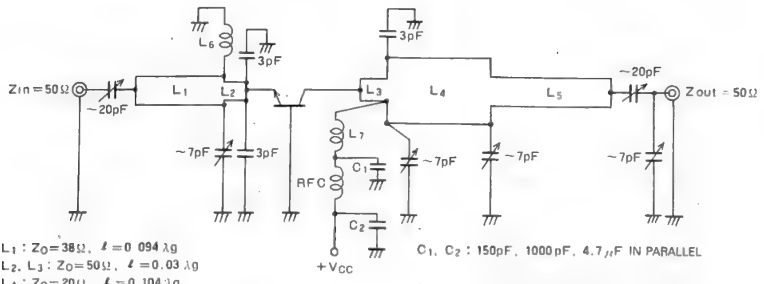
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	3			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	17			V
I_{CBO}	Collector cut-off current	V_{CB}=15V, I_E=0			2	mA
I_{EBO}	Emitter cut-off current	V_{EB}=2V, I_C=0			2	mA
h_{FE}	DC Current gain *	V_{CE}=10V, I_C=0.1A	10	30	180	–
P_O	Output power	f=900MHz, V_{CC}=12.5V, P_{in}=1W	6	7		W
η_C	Collector efficiency		55	65		%

* Note. Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f=900MHz)



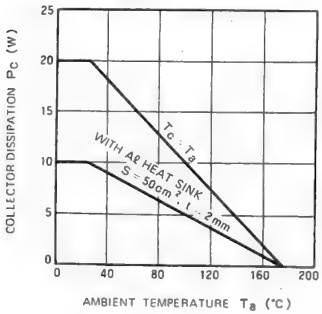
L_1 : Z_O=38Ω, ℓ=0.094 λg
L_2, L_3 : Z_O=50Ω, ℓ=0.03 λg
L_4 : Z_O=20Ω, ℓ=0.104 λg
L_5 : Z_O=38Ω, ℓ=0.123 λg
L_6 : 4D, 12T, OP(φ0.8 SILVER PLATED COPPER WIRE)
L_7 : ℓ=25, (φ1.0 SILVER PLATED COPPER WIRE)

C_1, C_2 : 150pF, 1000pF, 4.7μF IN PARALLEL

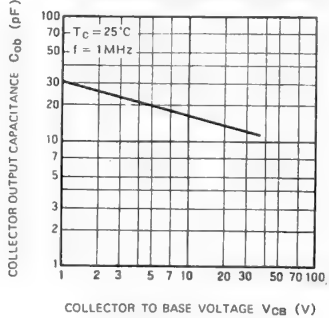
Note. Board Material Glass Teflon, t=1.6, ε_r=2.7
D, Inner Diameter, T, Turn Number, P, Pitch.
All dimensions in mm

TYPICAL PERFORMANCE DATA

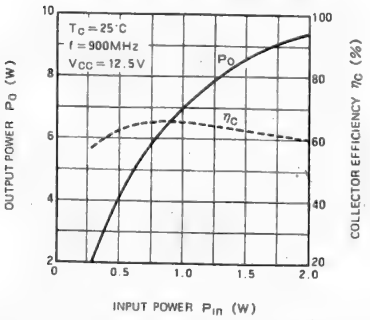
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



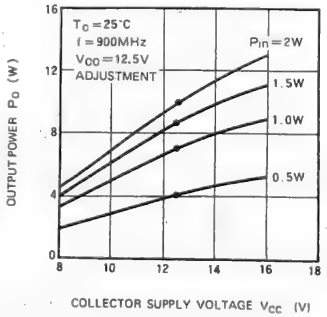
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER, COLLECTOR EFFICIENCY OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2933

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2933 is silicon NPN epitaxial planar type transitor specifically designed for power amplifiers in 800 ~ 940MHz band.

FEATURES

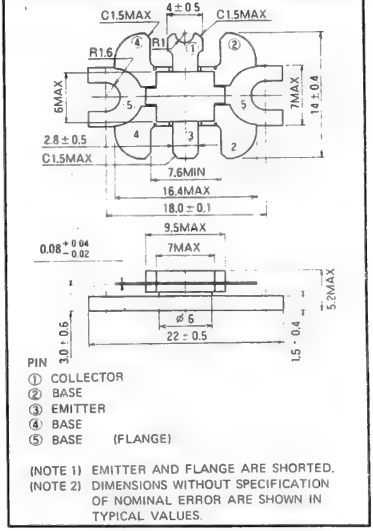
- High gain, High efficiency:
  G_{pb} = 6.7dB, $\eta_C \geqq$ 50%, $P_O \geqq$ 14W
  @f = 900MHz, V_{CC} = 12.5V, P_{in} = 3W
- Gold metalization of transistor die.
- Flange type ceramic package.
- Equivalent input/output series impedance:
  Z_{in} = 2.5 + j0.75(Ω), Z_{out} = 2.2 − j2.1(Ω)
  @f = 900MHz, V_{CC} = 12.5V, P_O = 16W
- Common base type.
- The ability withstand infruite VSWR when operated at f = 900MHz V_{CC} = 15.2V, P_O = 14W.

APPLICATION

Output stage of power amplifiers in 800MHz band mobile radio equipment

OUTLINE DRAWING

Dimensions in mm



PIN
① COLLECTOR
② BASE
③ EMITTER
④ BASE
⑤ BASE (FLANGE)

(NOTE 1) EMITTER AND FLANGE ARE SHORTED.
(NOTE 2) DIMENSIONS WITHOUT SPECIFICATION OF NOMINAL ERROR ARE SHOWN IN TYPICAL VALUES.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter		Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		3	V
V_{CEO}	Collector to emitter voltage		17	V
I_C	Collector current		4	A
P_C	Collector dissipation	T_a=25°C	3	W
		T_C=25°C	40	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 − +175	°C
Rth-a	Thermal resistance		50	°C/W
Rth-c			3.75	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

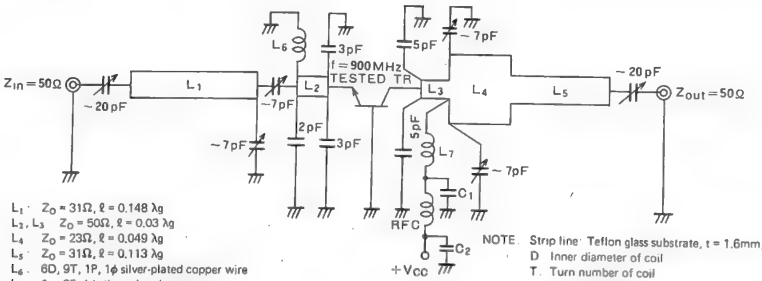
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	3			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			3	mA
h_{FE}	DC current gain *	V_{CE}=10V, I_C=0.2A	10	50	180	—
P_O	Output power	f=900MHz, V_{CC}=12.5V, Pin=3W	14	16		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

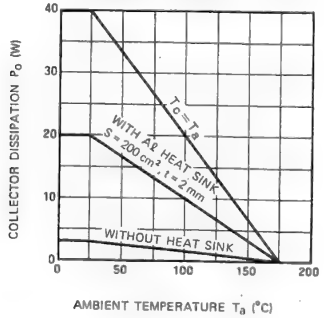


L_1 : $Z_O = 31\Omega$, $\ell = 0.148\ \lambda g$
L_2, L_3 : $Z_O = 50\Omega$, $\ell = 0.03\ \lambda g$
L_4 : $Z_O = 23\Omega$, $\ell = 0.049\ \lambda g$
L_5 : $Z_O = 31\Omega$, $\ell = 0.113\ \lambda g$
L_6 : 6D, 9T, 1P, 1ϕ silver-plated copper wire
L_7 : ℓ = 25, 1ϕ silver-plated copper wire
C_1 : 150pF, 1000pF, 22μF in parallel
C_2 : 150pF, 1000pF, 1μF in parallel

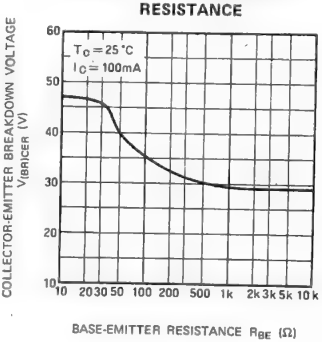
NOTE: Strip line: Teflon glass substrate, t = 1.6mm, $\varepsilon_s = 2.7$
D : Inner diameter of coil
T : Turn number of coil
P : Pitch of coil
ℓ : Length
Coil dimensions in mm

TYPICAL PERFORMANCE DATA

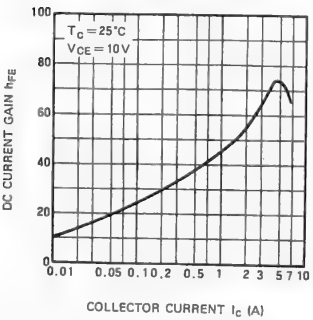
COLLECTOR LOSS VS. AMBIENT TEMPERATURE



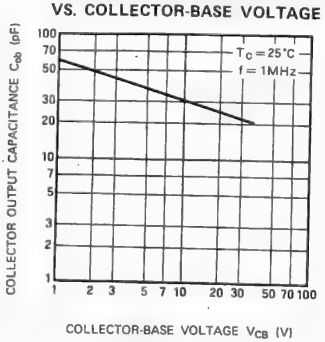
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



DC CURRENT AMPLIFICATION RATE VS. COLLECTOR CURRENT



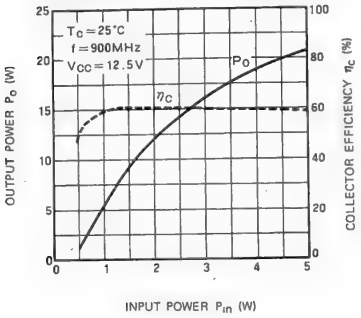
COLLECTOR OUTPUT CAPACITNCE VS. COLLECTOR-BASE VOLTAGE



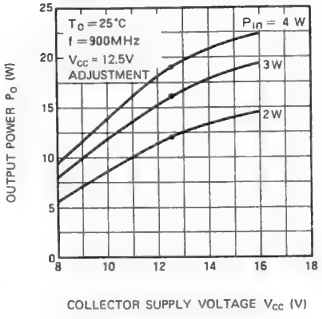
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER, COLLECTOR SUPPLY VOLTAGE VARIATION



2SC3001

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3001 is a silicon NPN epitaxial planar type transistor specifically designed for VHF power amplifier applications.

FEATURES

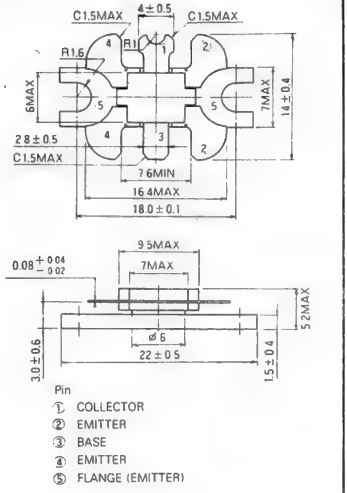
- High power gain: $G_{pe} \geqq 13$dB.
  @V_{CC}=7.2V, f=175MHz, P_{in}=0.3W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC}=9V, f=175MHz, P_O=6.0W.
- Flange type ceramic package.
- Z_{in}=1.5−j1.3Ω, Z_{out}=5.0−j1.2Ω
  @V_{CC}=7.2V, f=175MHz, P_O=6.0W.

APPLICATION

For output stage of 5W power amplifiers in VHF band portable type radio sets.

OUTLINE DRAWING

Dimensions in mm



Pin
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		3	A
P_C	Collector dissipation	T_C=25°C	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55∼+175	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)IEBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	3.5			V
$V_{(BR)ICBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cut-off current	V_{CB}=10V, I_E=0			500	μA
I_{EBO}	Emitter cut-off current	V_{EB}=2V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=5V, I_C=0.1A	20	50	180	—
P_O	Power Output	V_{CC}=7.2V, P_{in}=0.3W, f=175MHz	6	7		W
η_C	Collector efficiency		60	65		%

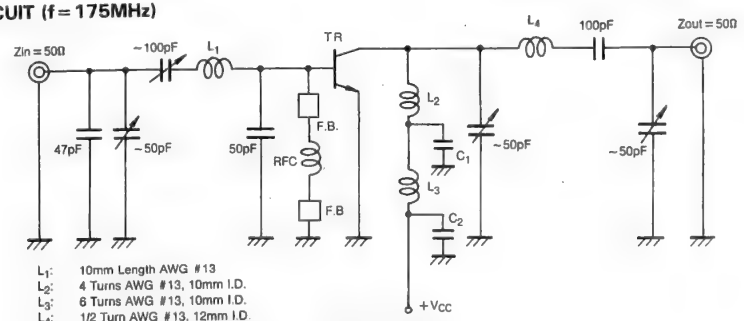
* Note: Pulse test, P_W=150μs, duty 5%

MITSUBISHI ELECTRIC

2SC3001

NPN EPITAXIAL PLANAR TYPE

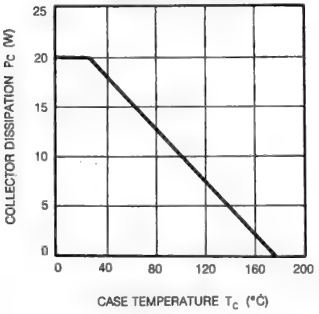
TEST CIRCUIT (f = 175MHz)



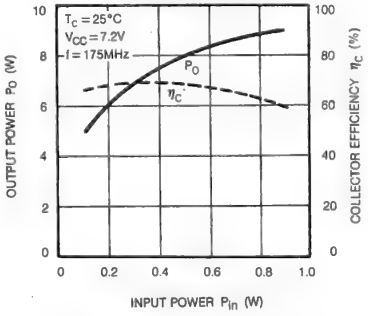
L_1: 10mm Length AWG #13
L_2: 4 Turns AWG #13, 10mm I.D.
L_3: 6 Turns AWG #13, 10mm I.D.
L_4: 1/2 Turn AWG #13, 12mm I.D.
RFC: 40 Turns AWG #32 Enameled wire Close Wound on 4mm O.D. 14mm Length Bakelite.
C_1: 220pF, 1000pF, 4700pF, 10μF in parallel.
C_2: 220pF, 1000pF, 4700pF, 10μF in parallel.

TYPICAL PERFORMANCE DATA

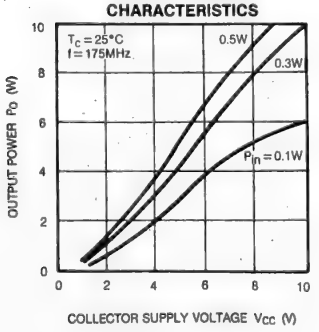
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



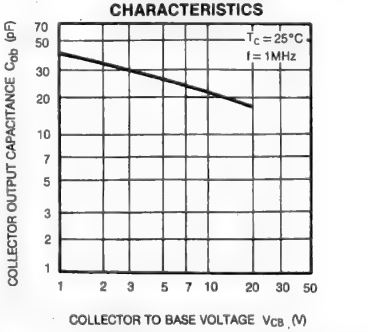
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS.



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS

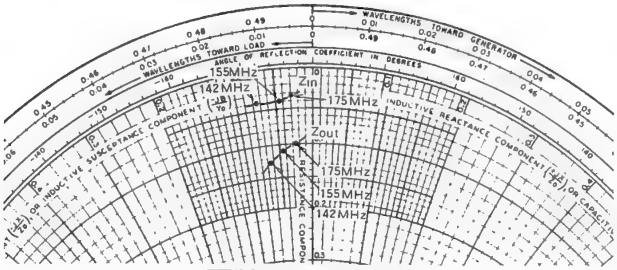


COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



NPN EPITAXIAL PLANAR TYPE

INPUT/OUTPUT IMPEDANCE VS.
FREQUENCY CHARACTERISTICS



f(MHz)	$Z_{in}(\Omega)$	$Z_{out}(\Omega)$
142	2.0—j3.6	6.0—j3.2
155	1.8—j2.0	5.4—j2.3
175	1.5—j1.3	5.0—j1.2
V_{CC}=7.2V, P_O=6W		

MITSUBISHI ELECTRIC

2SC3017

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3017 is a silicon NPN epitaxial planar type transistor specifically designed for VHF power amplifiers applications.

FEATURES

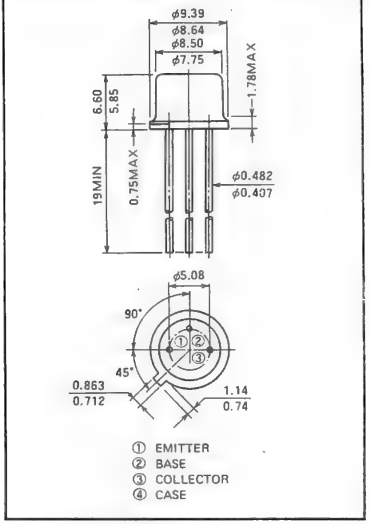
- High power gain: Gpe≧11dB
  @V_{CC}=7.2V, f=175MHz, P_{in}=0.1W
- Emitter ballasted construction.
- Emitter case type TO-39 package.
  (connected internally to emitter)
- Z_{in}=8−j12Ω, Z_{out}=11−j1Ω
  @V_{CC}=7.2V, f=175MHz, P_O=1.5W.

APPLICATION

For drive stage and output stage of power amplifiers in VHF band portable radio sets.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	9	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_C=25°C	4	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C)

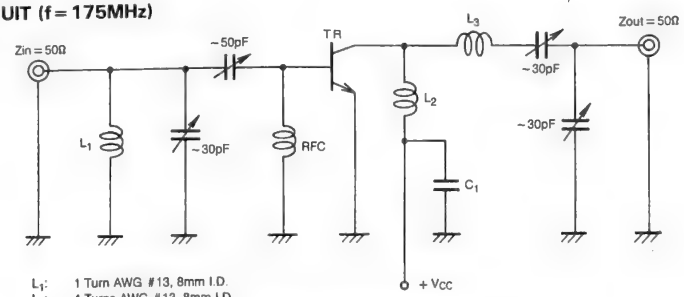
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=∞	9			V
I_{CBO}	Collector cut off current	V_{CB}=10V, I_E=0			200	μA
I_{EBO}	Emitter cut off current	V_{EB}=2V, I_C=0			200	μA
h_{FE}	DC forward current gain*	V_{CE}=5V, I_C=0.1A	20	50	180	—
P_O	Power Output	V_{CC}=7.2V, P_{in}=0.1W, f=175MHz	1.5	1.6		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W=150μs, duty 5%

2SC3017

NPN EPITAXIAL PLANAR TYPE

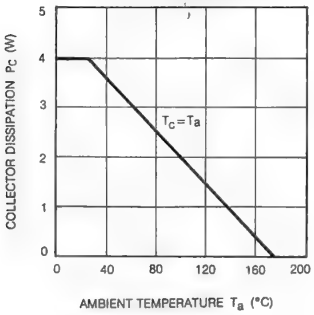
TEST CIRCUIT (f = 175MHz)



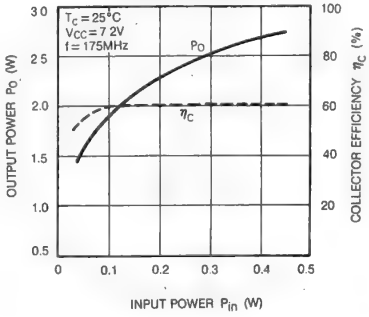
L_1: 1 Turn AWG #13, 8mm I.D.
L_2: 4 Turns AWG #13, 8mm I.D.
L_3: 2 Turns AWG #13, 8mm I.D.
RFC: 20 Turns AWG #26 Enameled wire Close Wound on 4mm O.D., 14mm Length Bakelite
C_1: 0.022μF, 0.047μF, 0.1μF in parallel.

TYPICAL PERFORMANCE DATA

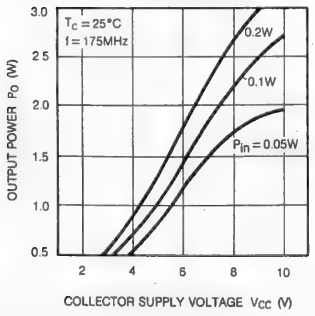
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS.



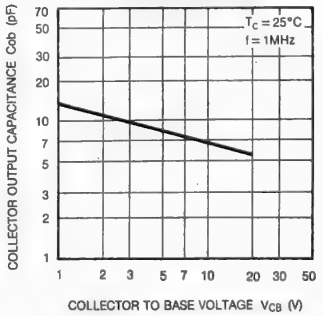
OUTPUT POWER COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS.



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS.



MITSUBISHI ELECTRIC

2SC3018

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3018 is a silicon NPN epitaxial planar type transistor designed for 7.2Volts VHF power amplifiers applications.

FEATURES

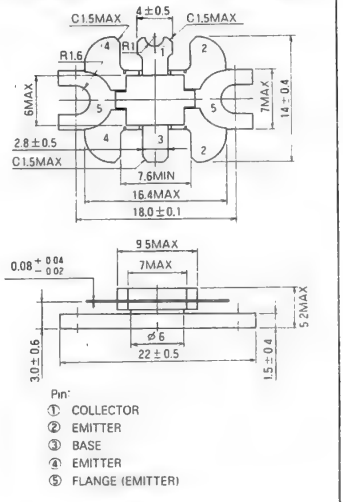
- High gain: $G_{pe} \geqq 13$dB @f = 175MHz, $V_{CC} = 7.2$V $P_{in} = 0.15$W.
- Convenient ceramic type package with flange for high gain and excellent heat dissipation.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC} = 9$V, $P_O = 3$W.

APPLICATION

Output stage of 2W portable type transmitter in VHF band.

OUTLINE DRAWING

Dimensions in mm



Pin:
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS ($T_C = 25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	9	V
I_C	Collector current		1.5	A
P_C	Collector dissipation	$T_C = 25°C$	10	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

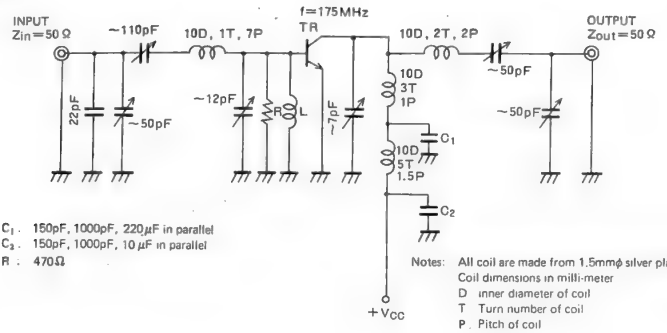
ELECTRICAL CHARACTERISTICS ($T_C = 25°C$)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E = 1$mA, $I_C = 0$	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C = 10$mA, $I_E = 0$	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C = 10$mA, $R_{BE} = \infty$	9			V
I_{CBO}	Collector cut off current	$V_{CB} = 10$V, $I_E = 0$			300	μA
I_{EBO}	Emitter cut off current	$V_{EB} = 2$V, $I_C = 0$			300	μA
h_{FE}	DC forward current gain *	$V_{CE} = 5$V, $I_C = 0.1$A	20	50	180	—
P_O	Power Output	$V_{CC} = 7.2$V, $P_{in} = 0.15$W, f = 175MHz	3.0	3.5		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, $P_W = 150\mu s$, duty 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

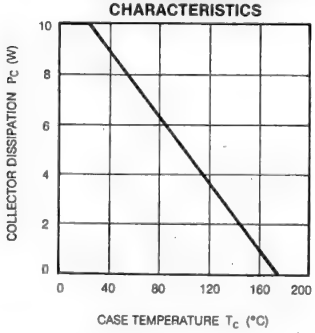


C_1 : 150pF, 1000pF, 220μF in parallel
C_2 : 150pF, 1000pF, 10 μF in parallel
R : 470Ω

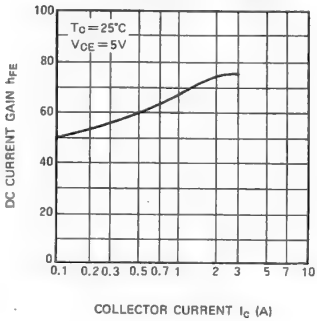
Notes: All coil are made from 1.5mmϕ silver plated copper wire
Coil dimensions in milli-meter
D inner diameter of coil
T Turn number of coil
P Pitch of coil

TYPICAL PERFORMANCE DATA

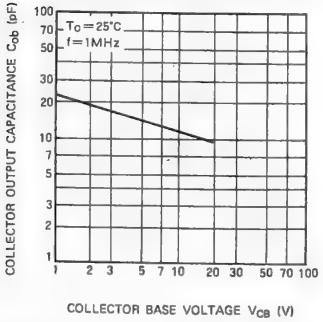
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



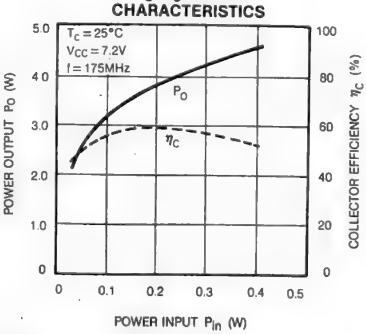
DC CURRENT GAIN VS. COLLECTOR CURRENT



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR BASE VOLTAGE



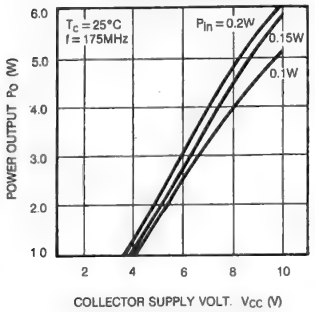
P_O, η_C VS. Pin CHARACTERISTICS



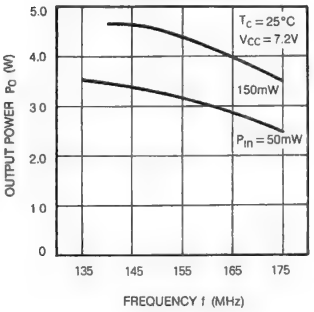
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

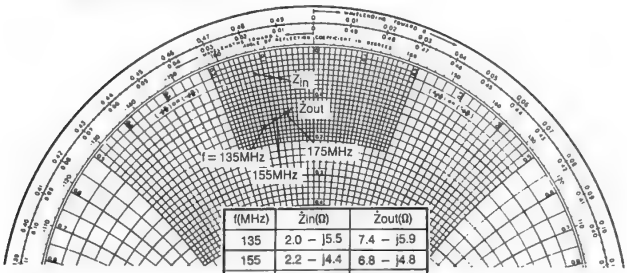
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER VS. FREQUENCY CHARCTERISTICS



INPUT, OUTPUT IMPEDANCE VS. FREQUENCY CHARCTERISTICS



f(MHz)	Żin(Ω)	Żout(Ω)
135	2.0 − j5.5	7.4 − j5.9
155	2.2 − j4.4	6.8 − j4.8
175	2.5 − j3.5	6.5 − j3.75

Condition: $V_{CC} = 7.2V$ $P_O = 3.0W$

2SC3019

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC3019 is silicon NPN epitaxial planar type transistor designed for RF power amplifiers in UHF band.

FEATURES

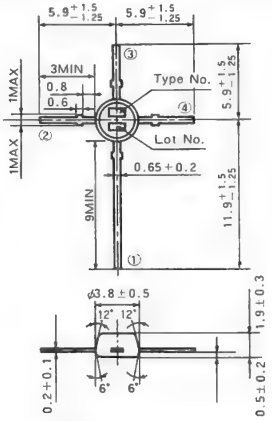
- High power gain: $G_{pe} \geqq 14dB$
  @P_O = 0.5W, f = 520MHz, V_{CC} = 12.5V
- Emitter ballasted construction for high reliability and good performance
- Small-disc-mold type package
- Collector dissipation: P_C = 0.6W, (@T_a = 25°C)
- Input/Output impedance:
  Z_{in} = 2.6 – j3.0Ω, Z_{out} = 16.5 – j56Ω
  @f = 520MHz, V_{CC} = 12.5V, P_O = 0.5W

APPLICATION

Exciter stage in UHF band mobile radio application

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	17	V
I_C	Collector current		0.4	A
P_C	Collector dissipation	T_a=25°C	0.6	W
		T_C=25°C	0.9	W
T_j	Junction temperature		+135	°C
Tstg	Storage temperature		−55~+135	°C
Rth-a	Thermal resistance	Junction to ambient	250	°C/W
Rth-c		Junction to case	166	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

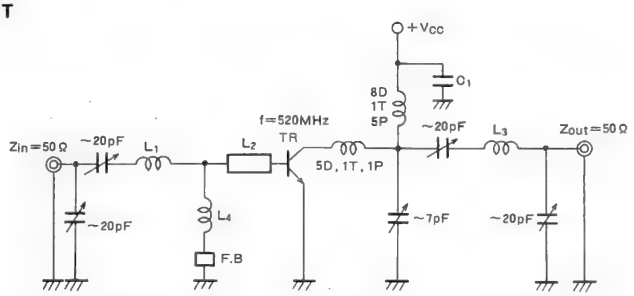
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4.0			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=50mA	20	70	180	—
P_O	Output power	V_{CC}=12.5V, f=520MHz, P_{in}=20mW	500	600		mW
η_C	Collector efficiency		40	50		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

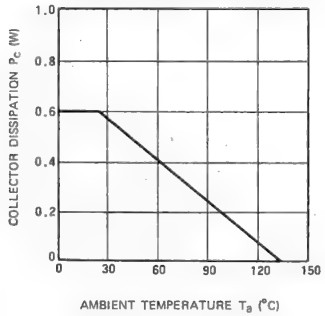


L_1: Length = 8, ϕ1.5 silver plated copper wire.
L_2: Width = 4, length = 12 (1.6 t glass-epoxy, ε_S = 4.7)
L_3: 10D, 1/2T, ϕ1.5 silver plated copper wire.
L_4: 3D, 8T, ϕ0.8 enameled wire.
C_1: 220pF, 330pF, 2200pF, 4700pF, 10μF in parallel

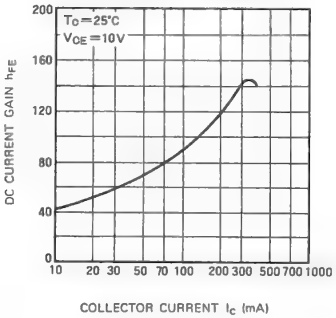
NOTES: ϕ1.5 silver plated copper wire except L_2 and L_4.
Dimension in milli-meter
D: Inner diameter of coil ferrite bead
T: Turn number of coil
P: Pitch of coil
F.B: Ferrite bead

TYPICAL PERFORMANCE DATE

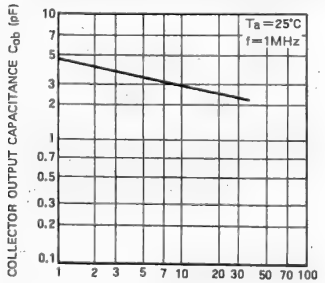
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



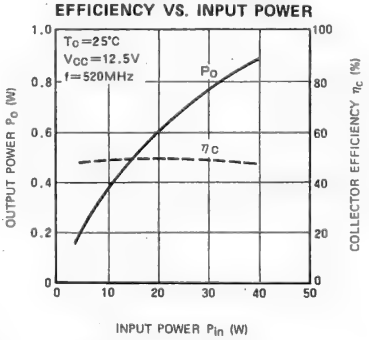
DC CURRENT GAIN VS. COLLECTOR CURRENT



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE

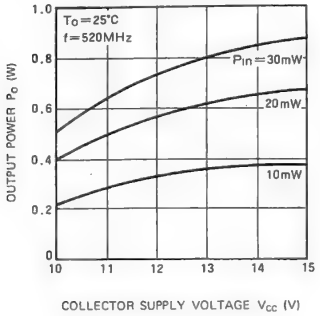


OUTPUT POWER · COLLECTOR EFFICIENCY VS. INPUT POWER

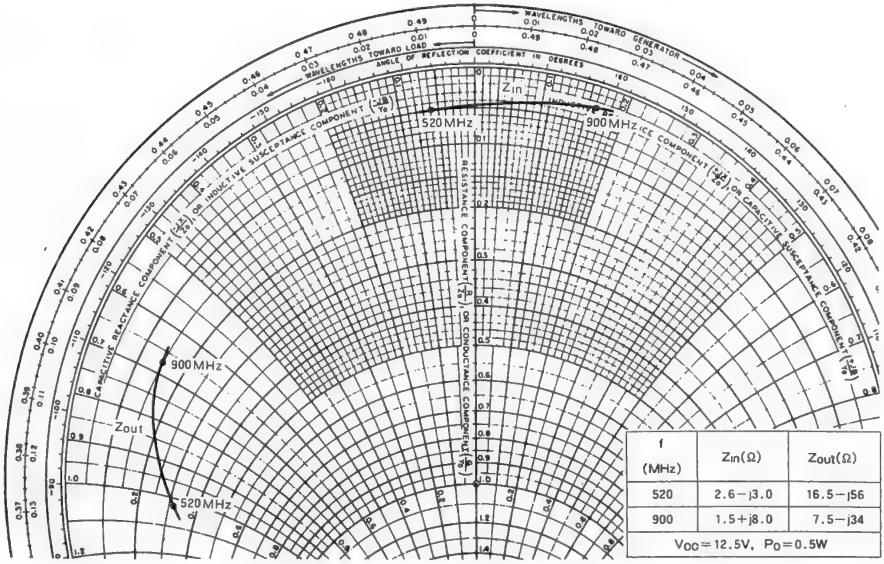


NPN EPITAXIAL PLANAR TYPE

OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



INPUT/OUTPUT IMPEDANCE



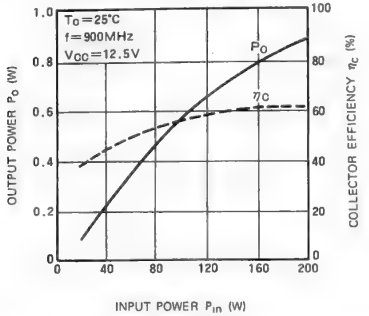
f (MHz)	Zin(Ω)	Zout(Ω)
520	2.6−j3.0	16.5−j56
900	1.5+j8.0	7.5−j34
V_{DD}=12.5V, P_O=0.5W		

MITSUBISHI ELECTRIC

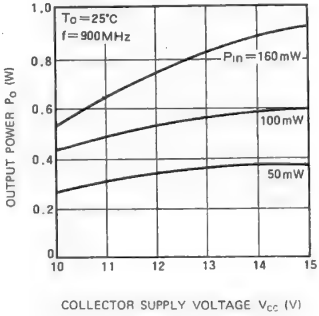
NPN EPITAXIAL PLANAR TYPE

REFERENCE DATA (f = 900MHz)

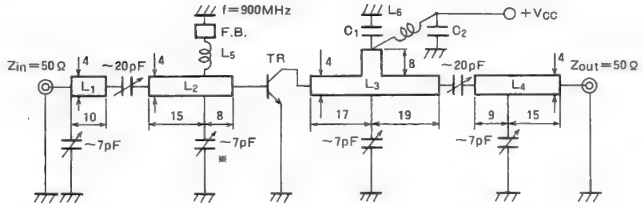
OUTPUT POWER · COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE

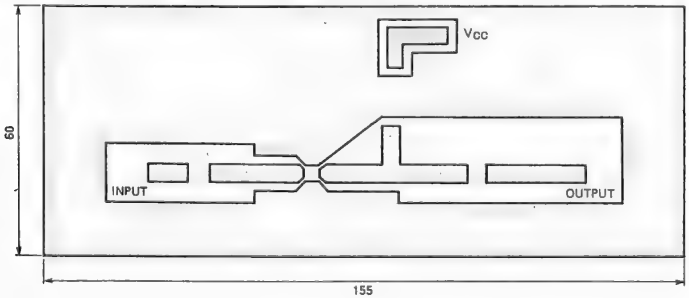


TEST CIRCUIT



L_1~L_4 : Strip-line 1.6 t glass-teflon ϵ_r = 2.7 Unit : mm
L_5 : 4D, 6T, AWG #20 enameled wire (ϕ0.8 mm)
L_6 : 4D, 5T, AWG #20 enameled wire (ϕ0.8 mm)
F.B. : Ferrite bead
C_1 : 1000pF in parallel
C_2 : 100pF, 56pF, 560pF, 4.7μF in parallel

MATCHING PATTERN



2SC3020

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3020 is a silicon NPN epitaxial planar type transistor designed for UHF power amplifier applications.

FEATURES

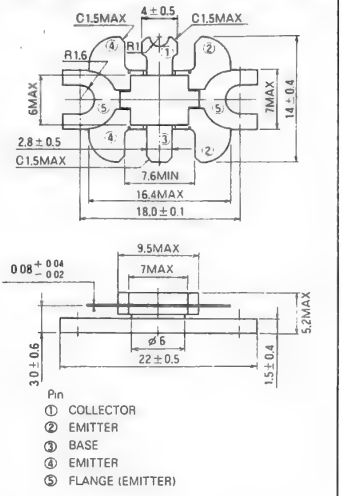
- High gain: $G_{pe} \geqq 10$dB, @f = 520MHz, $V_{CC} = 12.5$V, $P_{in} = 0.3$W.
- High ruggedness: Ability to withstand more than 20:1 load VSWR (all phase) when operated at $V_{CC} = 15.2$V, f = 520MHz, $P_O = 3$W.
- Emitter ballasted construction.
- Low thermal resistance: $R_{th} = 15$ °C/W($T_C = 25$°C)
- Convenient flange type ceramic package.

APPLICATION

For drive stage and output stage of 400MHz band mobile radio.

OUTLINE DRAWING

Dimensions in mm



Pin
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4.0	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	$T_C = 25$°C	10	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55 ~ +175	°C

ELECTRICAL CHARACTERISTICS ($T_C = 25$°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E = 1$mA, $I_C = 0$	4.0			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C = 10$mA, $I_E = 0$	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C = 10$mA, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cut off current	$V_{CB} = 15$V, $I_E = 0$			300	μA
I_{EBO}	Emitter cut off current	$V_{EB} = 3.0$V, $I_C = 0$			300	μA
h_{FE}	DC forward current gain*	$V_{CE} = 10$V, $I_C = 0.1$A	10	50	180	—
P_O	Power Output	$V_{CC} = 12.5$V, $P_{in} = 0.3$W, f = 520MHz	3.0	3.5		W
η_C	Collector efficiency		50	55		%

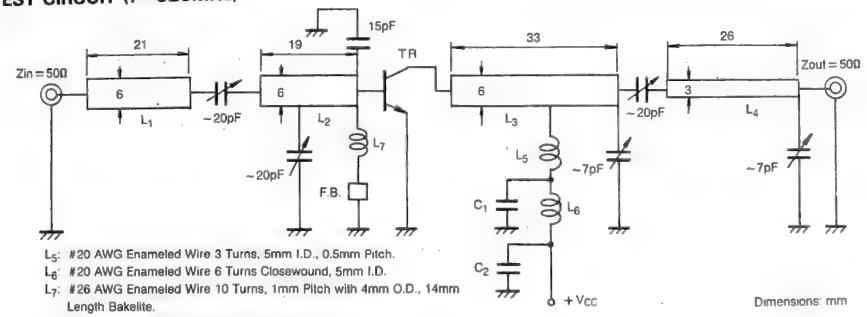
* Note: Pulse test, $P_W = 150\mu$s, duty = 5%

MITSUBISHI ELECTRIC

2SC3020

NPN EPITAXIAL PLANAR TYPE

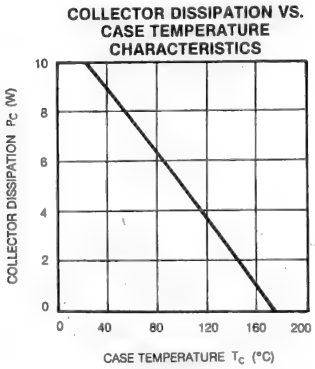
TEST CIRCUIT (f = 520MHz)

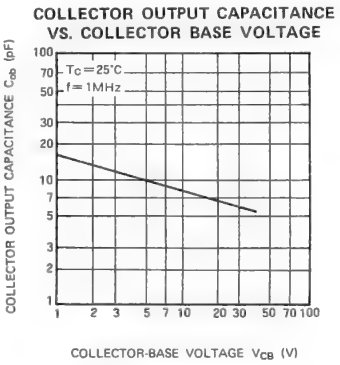


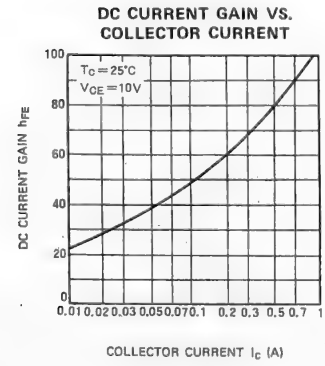
L_5: #20 AWG Enameled Wire 3 Turns, 5mm I.D., 0.5mm Pitch.
L_6: #20 AWG Enameled Wire 6 Turns Closewound, 5mm I.D.
L_7: #26 AWG Enameled Wire 10 Turns, 1mm Pitch with 4mm O.D., 14mm Length Bakelite.
$L_1 \sim L_4$: Microstripe (Board: 1.6mm Glass Teflon $\varepsilon_S = 2.7$)
C_1, C_2: 82pF, 220pF, 4700pF, 10μF in parallel.

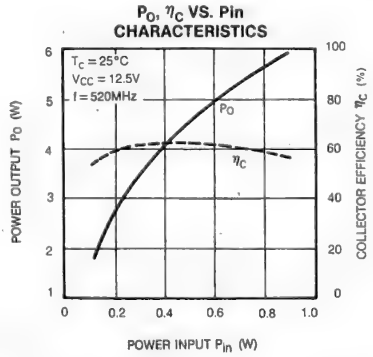
Dimensions: mm

TYPICAL PERFORMANCE DATA



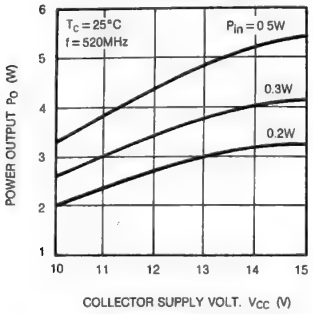




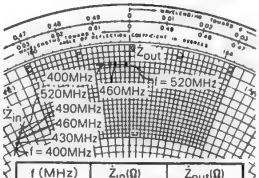


NPN EPITAXIAL PLANAR TYPE

OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



SERIES INPUT AND OUTPUT IMPEDANCE VS. FREQUENCY CHARACTERISTICS



f (MHz)	$\dot{Z}_{in}(\Omega)$	$\dot{Z}_{out}(\Omega)$
400	1.7−j2.9	8.0−j15
430	1.75−j2.1	7.5−j14.5
460	1.85−j1.35	7.0−j14
490	1.85−j0.3	6.5−j13.5
520	2.1+j0.85	6.0−j13

Conditions:
P_O = 3.0W, T_C = 25°C, V_{CC} = 12.5V

MITSUBISHI ELECTRIC

2SC3021

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3021 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifiers applications.

FEATURES

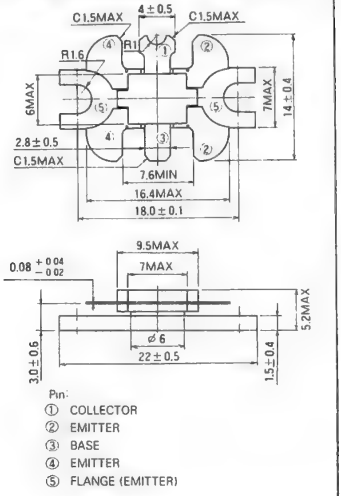
- High power gain: $G_{pe} \geqq 7.6$dB
  @$V_{CC}=12.5$V, f=520MHz, $P_{in}=1.2$W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC}=15.2$V, f=520MHz, $P_O=7$W.
- Flange type ceramic package.
- $Z_{in}=2.2+j3.1\Omega$,
  $Z_{out}=6+j1.0\Omega$ @$V_{CC}=12.5$V, f=520MHz, $P_O=7$W.

APPLICATION

For output stage of 5W power amplifiers and drive stage of higher power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



Pin:
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS ($T_C=25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	$T_C=25°C$	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

ELECTRICAL CHARACTERISTICS ($T_C=25°C$)

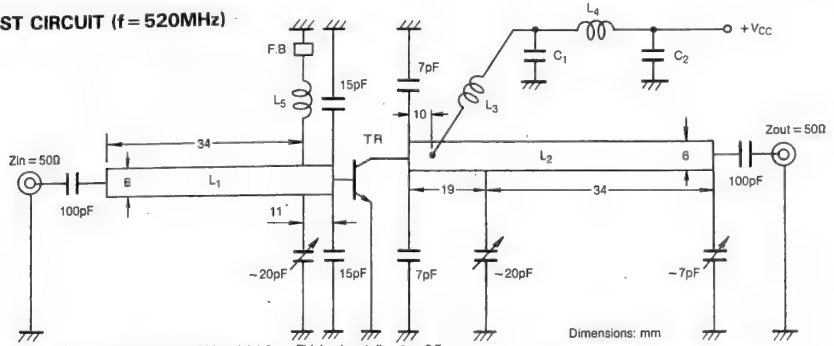
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E=5$mA, $I_C=0$	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C=10$mA, $I_E=0$	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C=50$mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cut off current	$V_{CB}=15$V, $I_E=0$			500	μA
I_{EBO}	Emitter cut off current	$V_{EB}=3$V, $I_C=0$			500	μA
h_{FE}	DC forward current gain *	$V_{CE}=10$V, $I_C=0.1$A	10	50	180	—
P_O	Power Output	$V_{CC}=12.5$V, $P_{in}=1.2$W, f=520MHz	7	8		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, $P_W=150\mu$s, duty 5%

2SC3021

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)



L_1,L_2: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$

L_3: 3 Turns AWG #20, 5mm I.D.

L_4: 6 Turns AWG #20, 5mm I.D

L_5: 10 Turns AWG #26 Enameled Wire on 4mm O.D., 14mm Length Bakelite.

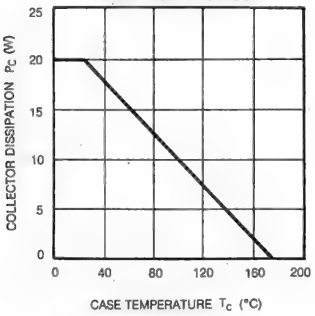
F.B.: Ferrite Bead

C_1: 82pF, 220pF, 4700pF, 10μF in parallel

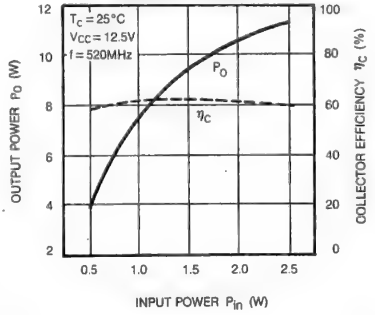
C_2: 82pF, 220pF, 10μF in parallel

TYPICAL PERFORMANCE DATA

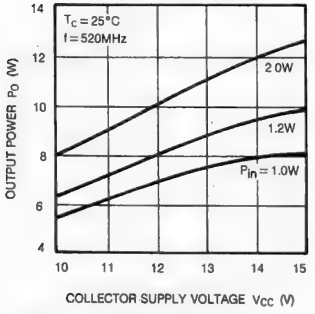
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



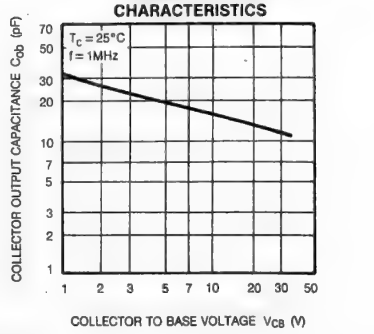
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



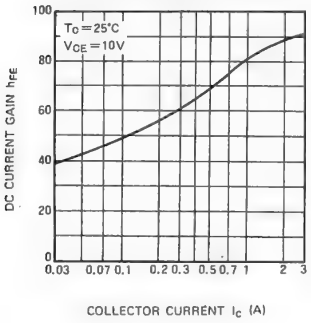
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

DC CURRENT GAIN
VS. COLLECTOR CURRENT



2SC3022

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3022 is a silicon NPN epitaxial planar type transistor specifically designed for UHF high power amplifier applications.

FEATURES

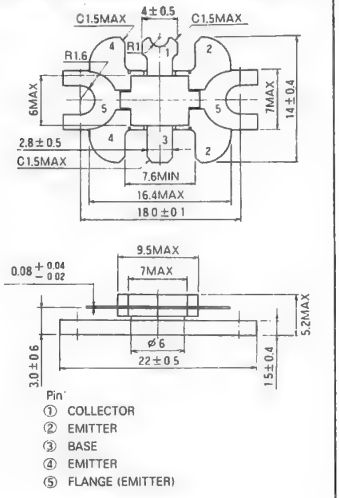
- High Power Gain: $G_{pe} \geqq 4.7$dB
  @V_{CC}=12.5V, f=520MHz, P_{in}=6W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC}=15.2V, f=520MHz, P_O=18W.
- Frange type ceramic package.
- Z_{in}=1.5+j2.0Ω, Z_{out}=2.8+j1.0Ω.
  @V_{CC}=12.5V, f=520MHz, P_O=18W.

APPLICATION

For output stage of 15W power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



Pin
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		7	A
P_C	Collector dissipation	T_C=25°C	50	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	3	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cut off current	V_{CB}=15V, I_E=0			2.0	mA
I_{EBO}	Emitter cut off current	V_{EB}=3V, I_C=0			3.0	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=1A	20	50	180	—
P_O	Power Output	V_{CC}=12.5V, P_{in}=6W, f=520MHz	18	22		W
η_C	Collector efficiency		55	60		%

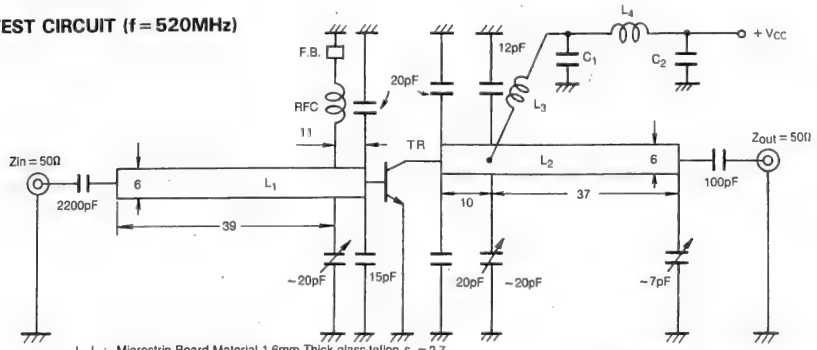
* Note. Pulse test, P_W=150μs, duty=5%

MITSUBISHI ELECTRIC

2SC3022

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)

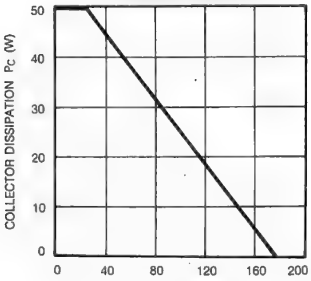


L_1,L_2: Microstrip Board Material 1.6mm Thick glass-teflon $\varepsilon_r = 2.7$
L_3: 3 Turns AWG #20, 8mm I.D.
L_4: 6 Turns AWG #20, 8mm I.D.
RFC: 8 Turns AWG #26 Enameled Wire on 4mm O.D., 14mm Length Bakelite

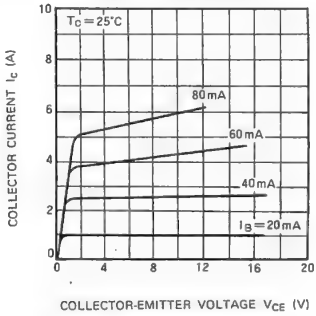
F.B: Ferrite Bead
C_1: 68pF, 3300pF, 4700pF, 33μF in parallel
C_2: 3300pF, 4700pF, 33μF in parallel

TYPICAL PERFORMANCE DATA

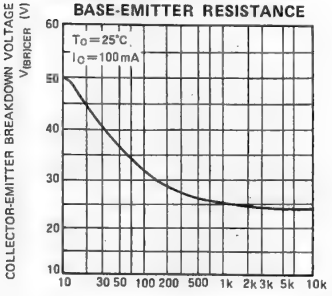
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



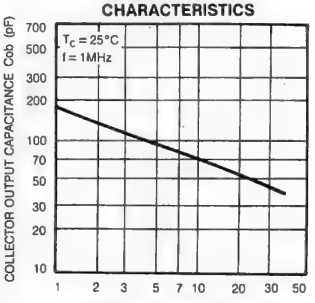
OUTPUT CHARACTRISTIC, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

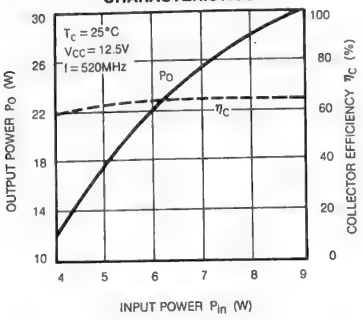


COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS

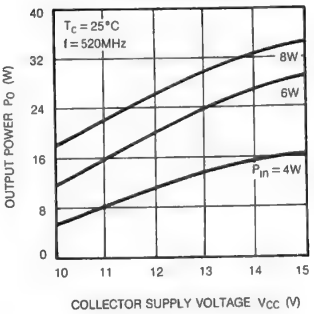


NPN EPITAXIAL PLANAR TYPE

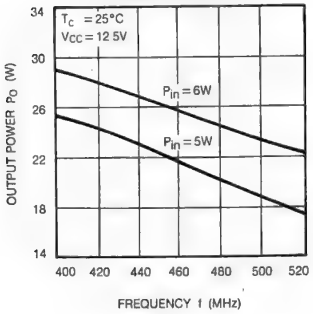
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



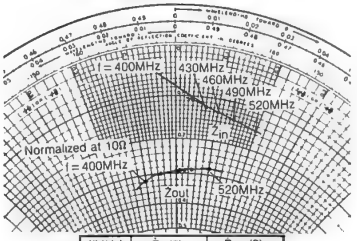
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISCTIS



OUTPUT POWER VS. FREQUENCY CHARACTERISTICS



SERIES INPUT AND OUTPUT IMPEDANCE VS. FREQUENCY CHARACTERISTICS



f(MHz)	$Z_{in}(\Omega)$	$Z_{out}(\Omega)$
400	1.10 + j0.5	3.2 − j1.0
430	1.15 + j0.75	3.0 − j0.5
460	1.25 + j1.0	2.95 ± j0.0
490	1.35 + j1.4	2.9 + j0.5
520	1.50 + j2.0	2.8 + j1.0

Conditions:
T_C = 25°C, V_{CC} = 12.5V, P_O = 18W

PRECAUTIONS FOR MOUNTING HIGH-FREQUENCY HIGH-OUTPUT TRANSISTOR FOR MOBILE RADIO EQUIPMENT

When mounting high-frequency, high-output transistors for mobile radio equipment (flange screw fastening part cut package), care should be taken to the following points.

1. When mounting the device to the heat sink, silicon compound should be applied to the heat sink and device heat radiating fin and apply the device to the heat sink using a proper fastening tool.
2. If the device is soldered directly to heat sink, excessive thermal stress will result in deteriorating the reliability. Do not use this mounting method.
3. Care should be taken, if the device is applied to the heat sink, the force of soldering the leads to the printed circuit board results in continual mechanical stress, deteriorating the reliability and performance of the system.
4. Refer to Mitsubishi's DATABOOK or manuals for transistors, small-signal diodes and integrated circuit modules for mounting and handling of the device.

MITSUBISHI ELECTRIC

2SC3101

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3101 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifiers applications.

FEATURES

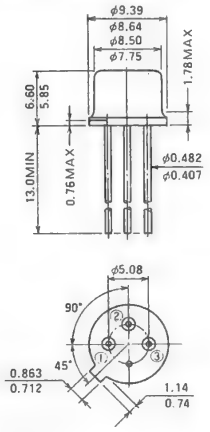
- High power gain: $G_{pe} \geqq 5.7$dB
  @V_{CC} = 12.5V, f = 520MHz, P_{in} = 0.8W
- Emitter ballasted construction
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at @V_{CC} = 15.2V, f = 520MHz, P_O = 3W.

APPLICATION

For drive stage and output stage of power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



Pin
① EMITTER (CASE)
② BASE
③ COLLECTOR

EIAJ: TC-5, TB-5B
JEDEC TO-39

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CEO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_C = 25°C	10	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C

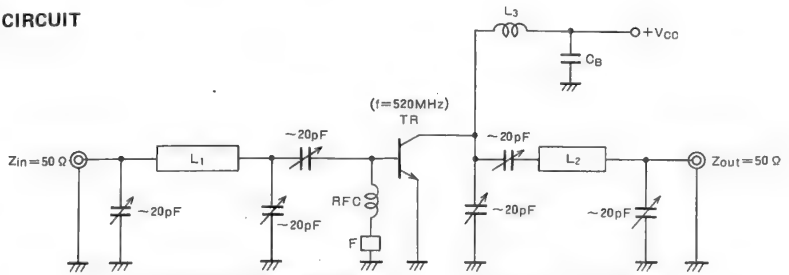
ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 1mA, I_C = 0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 10mA, I_E = 0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 10mA, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB} = 15V, I_E = 0			300	μA
I_{EBO}	Emitter cutoff current	V_{EB} = 2V, I_C = 0			300	μA
h_{FE}	DC forward current gain *	V_{CB} = 10V, I_C = 0.1A	10	50	180	—
P_O	Output power	V_{CC} = 12.5V, P_{in} = 0.8W, f = 520MHz.	3	3.5		W
η_C	Collector efficiency		50	60		%

* Note. Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

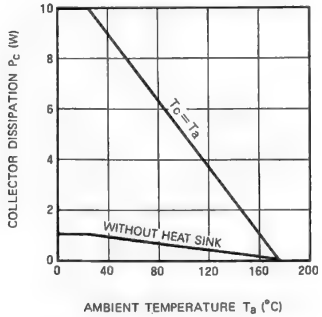


L_1 : Width 3.5, length 25, thinkness 0.3 cupper plate
L_2 : Width 3.5, length 17, thinkness 0.3 cupper plate
L_3 : 50, 2T, 1P, ϕ0.8 enameled wire
RFC : ϕ0, 5D, 6T, 0.5P ϕ0.8 enameled wire

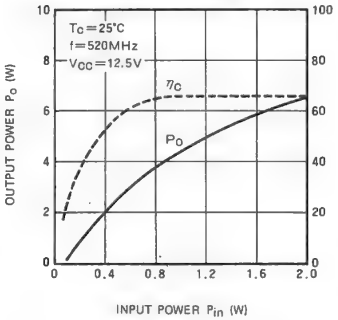
C_B : 150pF, 1500pF, 3 3μF in parallel
F : Ferrite bead
(Note) D : Inner diameter T : Turn numbers of coil
P : Pitch of coil Dimensions : mm

TYPICAL PERFORMANCE DATA

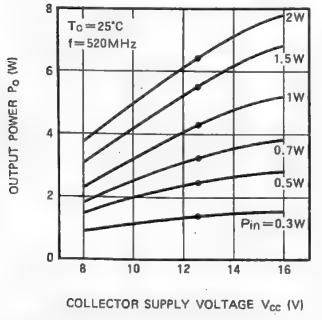
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS



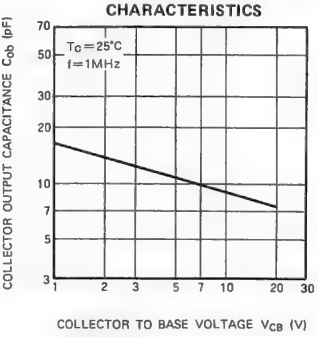
OUTPUT POWER COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



MITSUBISHI ELECTRIC

2SC3102

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3102 is a silicon NPN epitaxial planar type transistor specifically designed for high power amplifiers applications in UHF band.

FEATURES

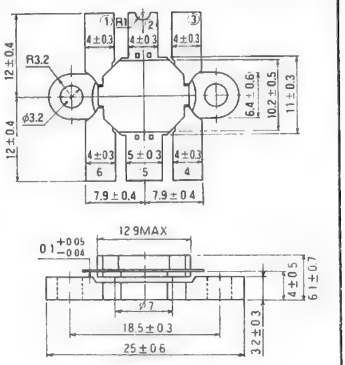
- High power output and high gain: $P_O \geqq 60W$, $Gpe \geqq 4.8dB$ @$V_{CC} = 12.5V$, $f = 520MHz$, $P_{in} = 20W$.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC} = 15.2V$, $P_O = 60W$, $f = 520MHz$.
- High reliability due to gold metalization die
- Flange type ceramic package
- $Z_{in} = 1.0 + j1.0\Omega$, $Z_{out} = 1.1 + j1.0\Omega$ @$V_{CC} = 12.5V$, $f = 520MHz$, $P_O = 60W$.

APPLICATION

For output stage of 50W power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



Pin:
1. EMITTER (FLANGE)
2. COLLECTOR
3. EMITTER (FLANGE)
4. EMITTER (FLANGE)
5. BASE
6. EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS ($T_C = 25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		18	A
P_C	Collector dissipation	$T_C = 25°C$	170	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

ELECTRICAL CHARACTERISTICS ($T_C = 25°C$)

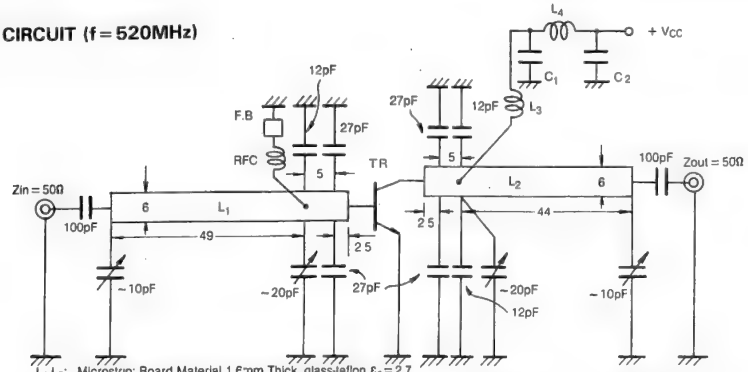
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)IEBO}$	Emitter to base breakdown voltage	$I_E = 20mA$, $I_C = 0$	4			V
$V_{(BR)ICBO}$	Collector to base breakdown voltage	$I_C = 20mA$, $I_E = 0$	35			V
$V_{(BR)ICEO}$	Collector to emitter breakdown voltage	$I_C = 0.2A$, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cut off current	$V_{CB} = 15V$, $I_E = 0$			5	mA
I_{EBO}	Emitter cut off current	$V_{EB} = 3V$, $I_C = 0$			5	mA
h_{FE}	DC forward current gain *	$V_{CE} = 10V$, $I_C = 2A$	10	50	180	–
P_O	Power Output	$V_{CC} = 12.5V$, $P_{in} = 20W$, $f = 520MHz$	60	65		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, $P_W = 150\mu s$, duty 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)



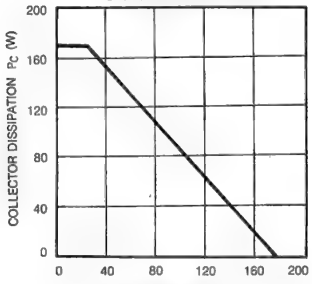
L_1,L_2: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_3: 1 Turn, AWG #13, 8mm I.D.
L_4: 4 Turns, AWG #13, 8mm I.D.
RFC: 8 Turns, AWG #20, 4mm I.D.

Dimensions: mm

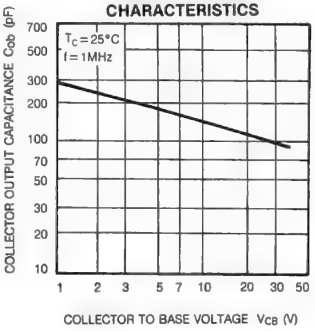
F.B: Ferrite Bead
C_1: 82pF, 220pF, 2200pF, 4700pF, 33μF in Parallel
C_2: 82pF, 220pF, 2200pF, 4700pF, 22μF in Parallel

TYPICAL PERFORMANCE DATA

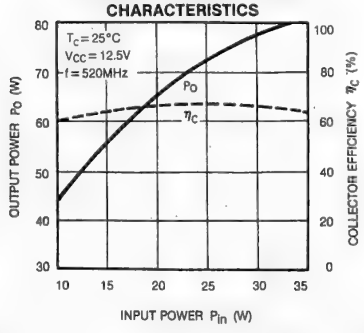
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



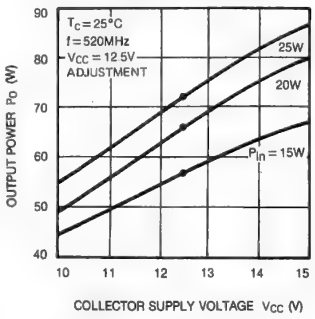
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS

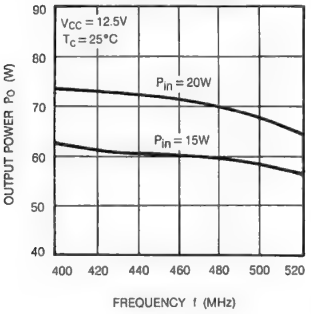


MITSUBISHI ELECTRIC

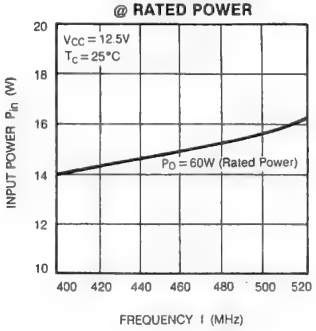
2SC3102

NPN EPITAXIAL PLANAR TYPE

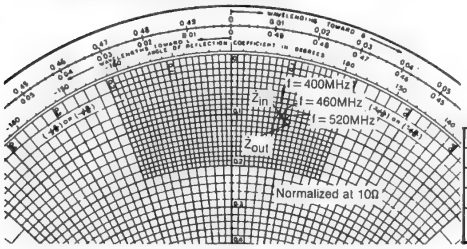
OUTPUT POWER VS. FREQUENCY CHARACTERISTICS



INPUT POWER VS. FREQUENCY CHARACTERISTICS @ RATED POWER

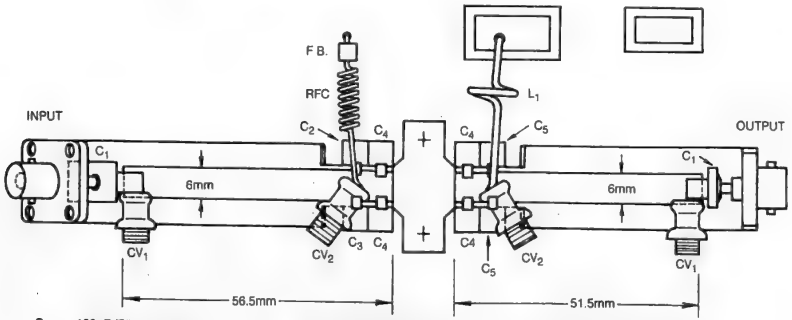


SERIES INPUT AND OUTPUT IMPEDANCE VS. FREQUENCY CHARACTERISTICS, 2SC3102



f(MHz)	$\dot{Z}_{in}(\Omega)$	$\dot{Z}_{out}(\Omega)$
400	0.9 + j0.9	1.1 + j1 0
460	0.95 + j0.95	1.18 + j0.9
520	1.0 + j1 0	1.25 + j0.8
Conditions: V_{CC} = 12 5V P_O = 60W		

TEST CIRCUIT BOARD LAYOUT (f = 520MHz)



C_1:	100pF (Ribbon Lead Mica)	CV_1:	~10pF (Air Variable Capacitor) muRata TTA 43 A 100A
C_2:	12pF (Ribbon Lead Mica)	CV_2:	~20pF (Air Variable Capacitor) muRata TTA 45 A 200A
C_3:	0	F.B.:	Ferrite Bead
C_4:	27pF (Ribbon Lead Mica)		
C_5:	12pF (Ribbon Lead Mica)		

RFC: 8 Turns, AWG #20, 4mm I.D.
L_1: 1 Turn, AWG #13, 8mm I.D.
Microstrip: Board Material
1.6mm Thick, glass-teflon εr = 2.7

2SC3103

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3103 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifier applications.

FEATURES

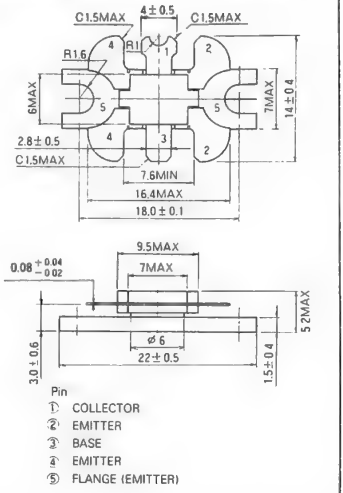
- High power gain: Gpe≧6.7dB
  @V_{CC}=7.2V, f=520MHz, P_{in}=0.6W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC}=9V, f=520MHz, P_O=2.8W
- Flange type ceramic package
- Z_{in}=1.8−j1.9 Ω, Z_{out}=6.0−j3.0 Ω @V_{CC}=7.2V, f=520MHz, P_O=2.8W.

APPLICATION

For drive stage of 5W power amplifiers and output stage of up to 2W power amplifiers in UHF band portable type radio sets.

OUTLINE DRAWING

Dimensions in mm



Pin
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	9	V
I_C	Collector current		1.5	A
P_C	Collector dissipation	T_C=25°C	10	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-c	Thermal resistance	Junction to case	15	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C)

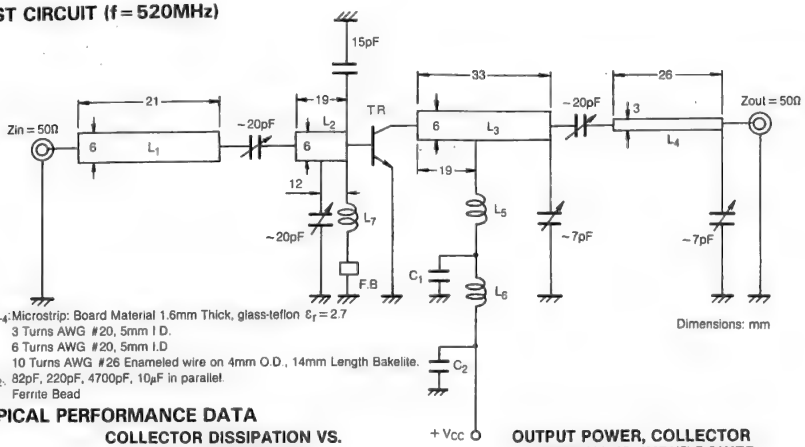
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=∞	9			V
I_{CBO}	Collector cut-off current	V_{CB}=10V, I_E=0			300	μA
I_{EBO}	Emitter cut-off current	V_{EB}=2V, I_C=0			300	μA
h_{FE}	DC forward current gain *	V_{CE}=5V, I_C=0.1A	10	50	180	—
P_O	Power Output	V_{CC}=7.2V, P_{in}=0.6W, f=520MHz	2.8	3.2		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W=150μs, duty 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)

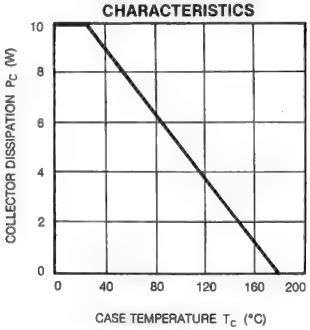


$L_1 \sim L_4$: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_5: 3 Turns AWG #20, 5mm I.D.
L_6: 6 Turns AWG #20, 5mm I.D.
L_7: 10 Turns AWG #26 Enameled wire on 4mm O.D., 14mm Length Bakelite.
C_1, C_2: 82pF, 220pF, 4700pF, 10μF in parallel
F.B.: Ferrite Bead

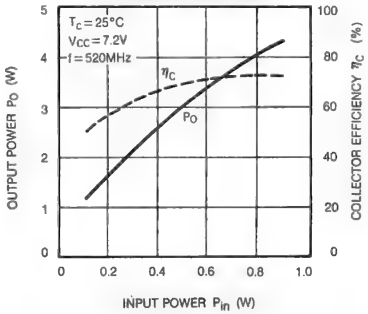
Dimensions: mm

TYPICAL PERFORMANCE DATA

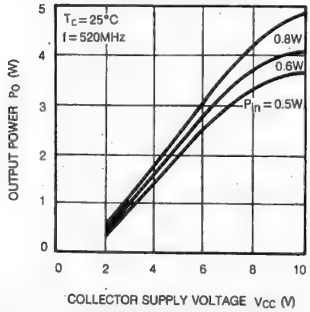
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



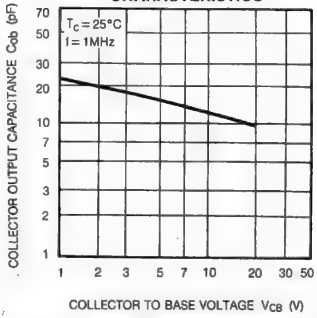
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS

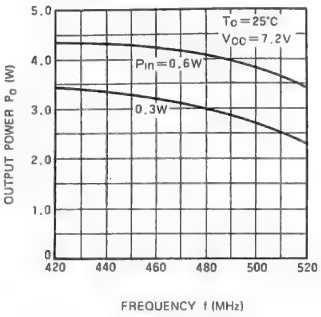


COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS

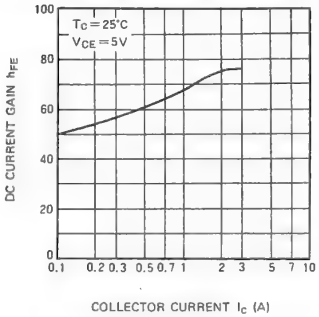


NPN EPITAXIAL PLANAR TYPE

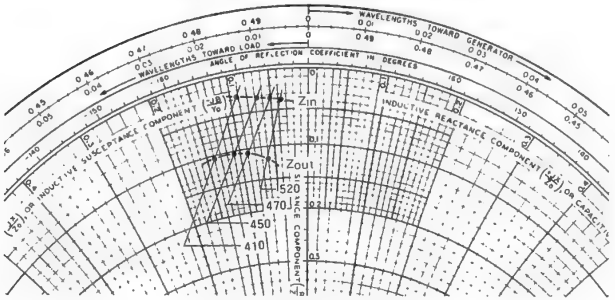
OUTPUT VS. FREQUENCY



DC CURRENT GAIN VS. COLLECTOR CURRENT



INPUT/OUTPUT IMPEDANCE VS. FREQUENCY



f (MHz)	Z_{in} (Ω)	Z_{out} (Ω)
410	1.5—j4.5	5.5—j7.0
450	1.5—j3.5	5.3—j5.5
470	1.6—j2.5	5.4—j4.5
520	1.8—j1.9	6.0—j3.0
V_{CC}=7.2V, P_O=2.8W		

MITSUBISHI ELECTRIC

2SC3104

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3104 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifier applications.

FEATURES

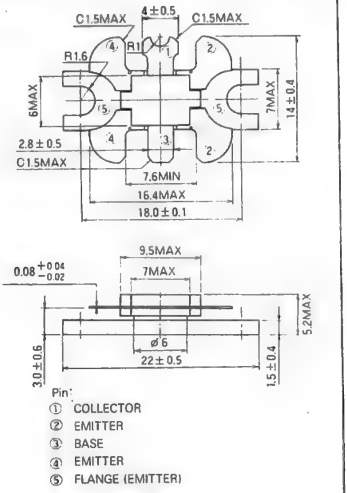
- High power gain: $G_{pe} \geqq 4.7$dB @$V_{CC}=7.2$V, f=520MHz, $P_{in}=2$W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC}=9$V, f=520MHz, $P_O=6$W.
- Flange type ceramic package.
- $\dot{Z}_{in}=1.6-0.4\ \Omega$, $\dot{Z}_{out}=3.5-j1.0\ \Omega$ at $V_{CC}=7.2$V, f=520MHz, $P_O=6$W.

APPLICATION

For output stage of 5W power amplifiers in UHF band portable type radio set.

OUTLINE DRAWING

Dimensions in mm



Pin:
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS ($T_c=25$°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		3	A
P_C	Collector dissipation	$T_C=25$°C	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 – +175	°C
Rth-c	Thermal resistance	Junction to case	7.5	°C/W

ELECTRICAL CHARACTERISTICS ($T_c=25$°C)

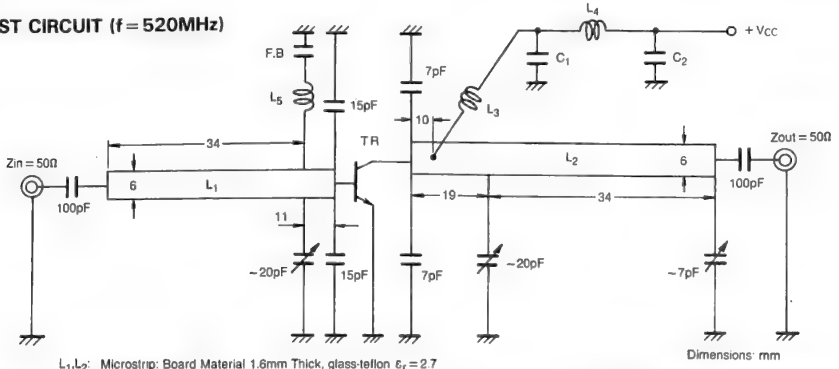
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E=5$mA, $I_C=0$	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C=10$mA, $I_E=0$	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C=50$mA, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cut off current	$V_{CB}=10$V, $I_E=0$			500	μA
I_{EBO}	Emitter cut off current	$V_{EB}=2$V, $I_C=0$			500	μA
h_{FE}	DC forward current gain*	$V_{CE}=5$V, $I_C=0.1$A	10	50	180	–
P_O	Power Output	$V_{CC}=7.2$V, $P_{in}=2$W, f=520MHz	6	7		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, $P_W=150$μs, duty 5%

2SC3104

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)

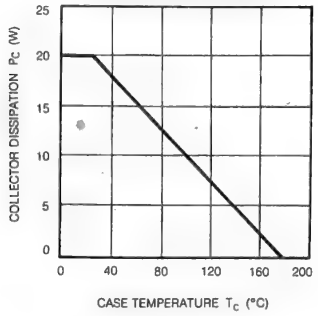


L_1,L_2: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_3: 3 Turns AWG #20, 5mm I.D.
L_4: 6 Turns AWG #20, 5mm I.D.
L_5: 10 Turns AWG #26 Enameled Wire on 4mm O.D., 14mm Length Bakelite.

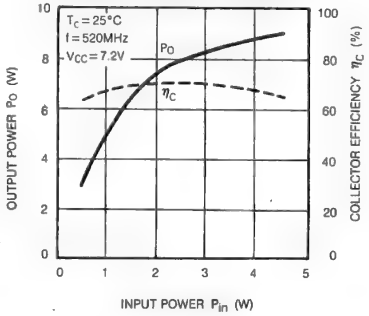
F.B.: Ferrite Bead
C_1: 82pF, 220pF, 4700pF, 10μF in parallel.
C_2: 82pF, 220pF, 10μF in parallel

TYPICAL PERFORMANCE DATA

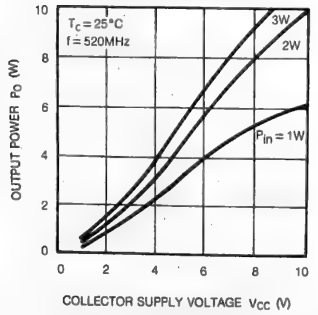
COLLECTOR DISSIPATION VS. CASE TEMPERATURE



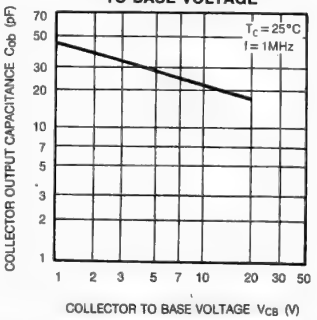
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



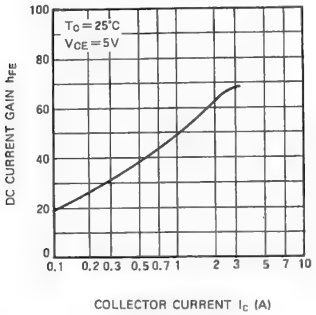
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



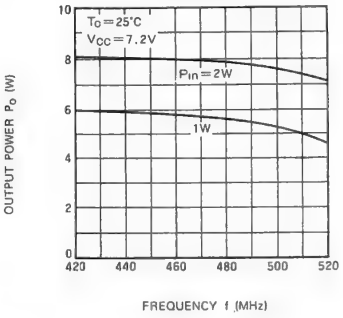
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

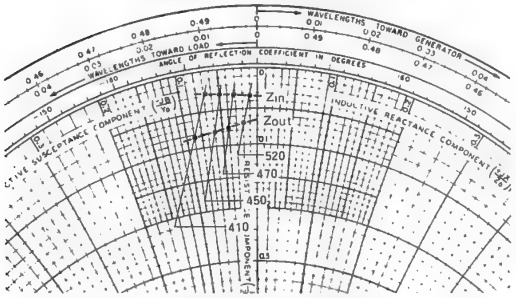
DC CURRENT GAIN VS. COLLECTOR CURRENT



OUTPUT POWER VS. FREQUENCY



INPUT/OUTPUT IMPEDANCE



f(MHz)	Z_{in}(Ω)	Z_{ot}(Ω)
410	1.4—j3.0	4.0—j4.4
450	1.4—j2.2	3.8—j3.0
470	1.5—j1.5	3.6—j2.0
520	1.6—j0.4	3.5—j1.0
V_{CC}=7.2V, P_O=6W		

2SC3105

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3105 is a silicon NPN epitaxial planar type transistor specifically designed for power amplifiers in the 800 ~ 900MHz band range.

FEATURES

- High gain, high efficiency
  $P_o \geqq 30W$, $G_{pb} \geqq 3.0dB$, $\eta_C = 50\%$ (MIN)
  @f = 850MHz, $V_{CC} = 12.5V$, $P_{in} = 15W$
- Emitter ballasted by diffusion resistance.
- Gold metalization of transistor die for good reliability.
- The ability withstand infinite VSWR when operated at $P_o = 30W$, $V_{CC} = 15.2V$.
- High Input-Impedance Transistor (HI^2T); internal input matching network.
- Common-base type.

APPLICATION

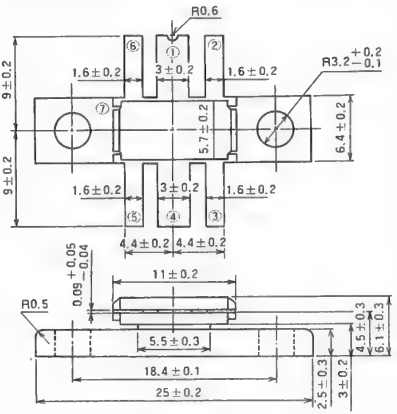
For RF power amplifiers in the 800 ~ 900MHz band range, especially suitable for mobile radio applications.

SERIES EQUIVALENT INPUT/OUTPUT IMPEDANCE

$Z_{in} = 2.75 - j0.65(\Omega)$, $Z_{out} = 3.45 + j0.15(\Omega)$, @f = 850MHz, $V_{CC} = 12.5V$, $P_o = 30W$.

OUTLINE DRAWING

Dimensions in mm



PIN
① COLLECTOR
② BASE
③ BASE
④ EMITTER
⑤ BASE
⑥ BASE
⑦ FLANGE (BASE)

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CEO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		10	A
P_C	Collector dissipation	T_C = 25°C	80	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise specified)

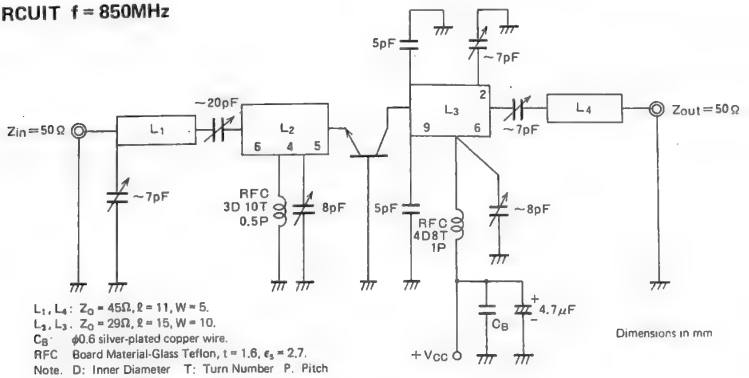
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E = 10mA$, $I_C = 0$	3			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C = 10mA$, $I_E = 0$	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C = 0.1A$, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cutoff current	$V_{CB} = 15V$, $I_E = 0$			5	mA
I_{EBO}	Emitter cutoff current	$V_{EB} = 2V$, $I_C = 0$			5	mA
h_{FE}	DC forward current gain *	$V_{CE} = 10V$, $I_C = 1A$	10	30	180	—
P_O	Output power	$V_{CC} = 12.5V$, $P_{in} = 15W$, f = 850MHz	30	35		W
η_C	Collector efficiency		50	55		%

* Note: Pulse test, $P_W = 150\mu s$, duty = 5%

MITSUBISHI ELECTRIC

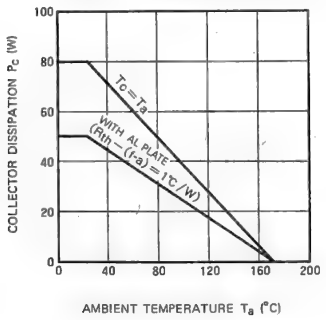
NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT f = 850MHz

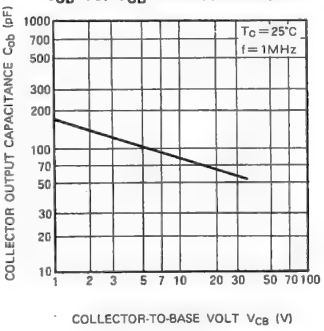


TYPICAL CHARACTERISTICS

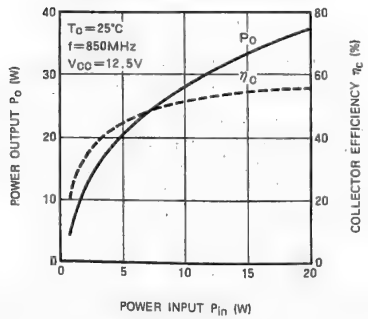
Pc VS. Ta CHARACTERISTICS



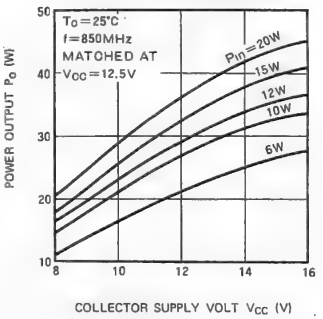
Cob VS. VCB CHARACTERISTICS



Po, ηc VS. Pin CHARACTERISTICS



Po VS. Vcc CHARACTERISTICS



2SC3133

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC3133 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in HF band mobile radio applications.

FEATURES

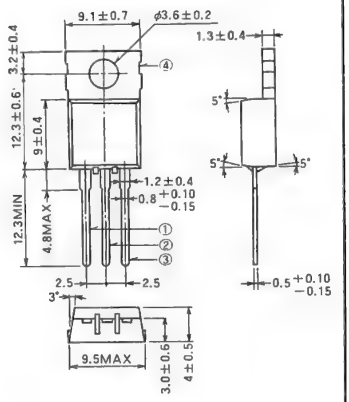
- High power gain: $G_{pe} \geqq 14$dB
  @f = 27MHz, V_{CC} = 12V, P_O = 13W
- Emitter ballasted construction for high reliability and good performances.
- High ruggedness: The ability withstand infinite VSWR when operated at f = 27MHz, P_O = 16W, V_{CC} = 16V.
- Intermodulation distortion: IMD $\leqq$ −25dB
  @f = 27MHz, V_{CC} = 12V, P_O = 13W (PEP)
- Input/output impedance:
  Z_{in} = 1.8 − j2.5(Ω), Z_{out} = 7.0 − j3.5(Ω)
  @f = 27MHz, V_{CC} = 12V, P_O = 13W

APPLICATION

10 watts output power amplifiers in HF band SSB mobile radio application.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		60	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	25	V
I_C	Collector current		6	A
P_C	Collector dissipation	T_a = 25°C	1.5	W
		T_C = 25°C	20	W
T_j	Junction temperature		150	°C
T_{stg}	Storage temperature		−55 ~ +150	°C
Rth-a	Thermal resistance	Junction to ambient	83.3	°C/W
Rth-c		Junction to case	6.25	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

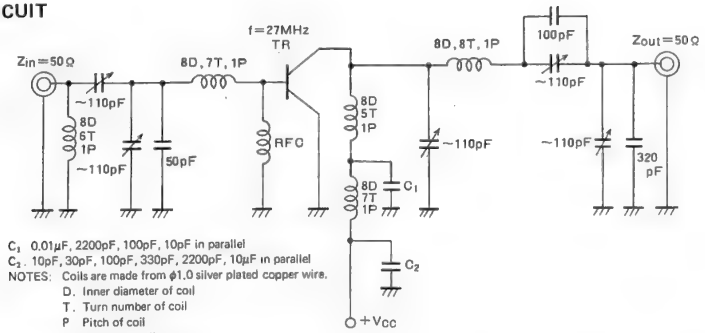
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 1mA, I_C = 0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 5mA, I_E = 0	60			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 10mA, R_{BE} = ∞	25			V
I_{CBO}	Collector cutoff current	V_{CB} = 30V, I_E = 0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB} = 4V, I_C = 0			500	μA
h_{FE}	DC current gain*	V_{CE} = 12V, I_C = 10mA	10	50	180	—
P_O	Output power	f = 27MHz, V_{CC} = 12V, P_{in} = 0.5W	13	16		W
η_C	Collector efficiency		60	70		%

* Note. Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

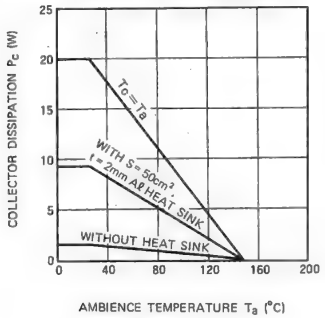
TEST CIRCUIT



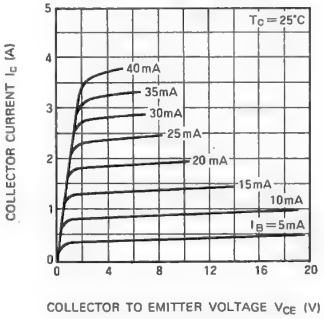
C_1 0.01μF, 2200pF, 100pF, 10pF in parallel
C_2 10pF, 30pF, 100pF, 330pF, 2200pF, 10μF in parallel
NOTES: Coils are made from φ1.0 silver plated copper wire.
D. Inner diameter of coil
T. Turn number of coil
P Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATE

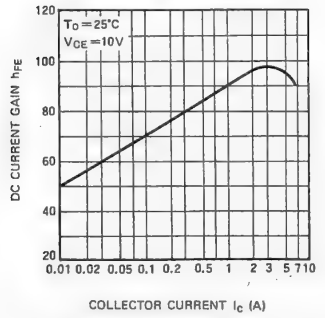
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



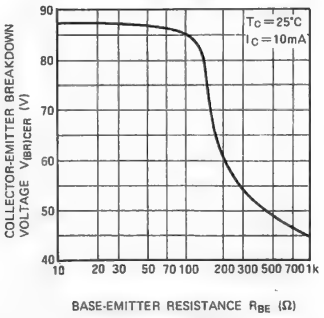
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

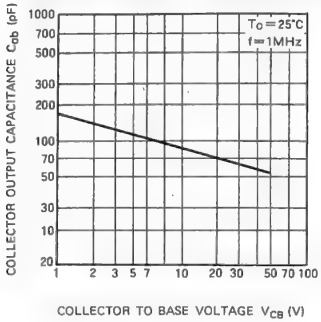


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

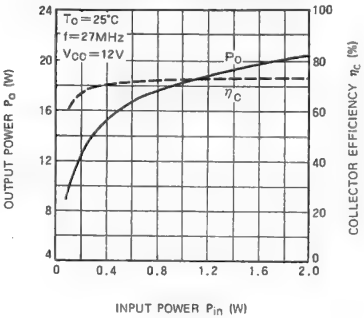


NPN EPITAXIAL PLANAR TYPE

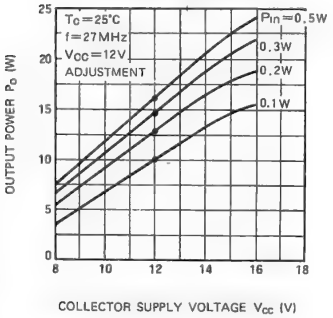
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC3240

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC3240 is a silicon NPN epitaxial planar type transistor specifically designed for high power amplifiers in HF band.

FEATURES

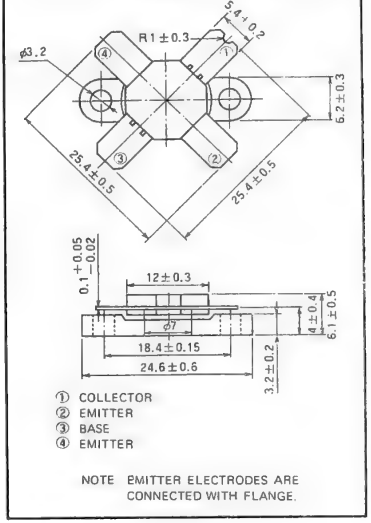
- High gain: $G_{pe} \geqq 11.5$dB, $P_O \geqq 100$W
  @f = 30MHz, V_{CC} = 12.5V, P_{in} = 7W
- High ruggedness: Ability to withstand 20:1 load VSWR when operated at f = 30MHz, P_O = 100W, V_{CC} = 15.2V.
- Emitter ballasted construction
- Low thermal resistance ceramic package with flange.
  Input-output impedance
  Z_{in} = 0.4 – j0.8 (Ω)
  Z_{out} = 1.0 – j1.1 (Ω)
  @f = 30MHz, V_{CC} = 12.5V, P_O = 100W

APPLICATION

Output stage of transmitter in HF band SSB mobile radio sets.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER
③ BASE
④ EMITTER

NOTE EMITTER ELECTRODES ARE CONNECTED WITH FLANGE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	20	V
I_C	Collector current		25	A
P_O	Collector dissipation	T_a=25°C	8	W
		T_C=25°C	270	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-a	Thermal resistance	Junction to ambient	18.7	°C/W
Rth-c		Junction to case	0.556	°C/W

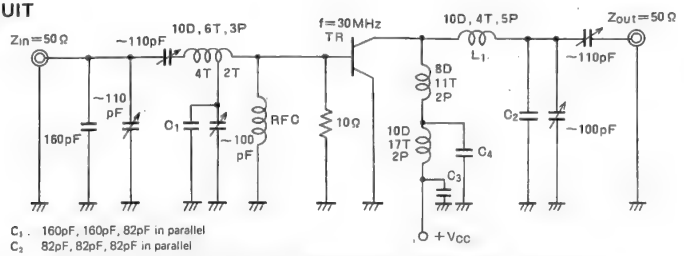
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=20mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=20mA, I_E=0	50			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=100mA, R_{BE} = ∞	20			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			5	mA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=1A	10	50	180	—
P_O	Output power	f=30MHz, V_{CC}=12.5V, P_{in}=7W	100	110		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

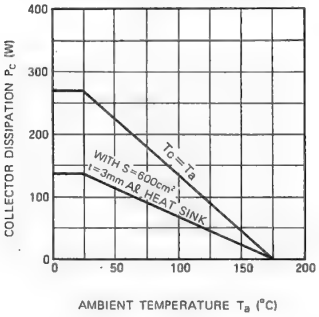


C_1 : 160pF, 160pF, 82pF in parallel
C_2 : 82pF, 82pF, 82pF in parallel
C_3 : 100pF, 4700pF, 4700pF, 0.22μF, 0.22μF, 33μF, 330μF in parallel
C_4 : 100pF, 220pF, 4700pF, 0.1μF, 330μF is parallel
RFC 27 Turns 1φ enameled wire

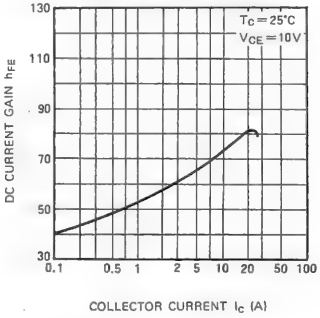
NOTES: All coils but L_1 are made from1 5φmm silver plated copper wire, L_1 is made from 2.3φmm copper wire
D Inner diameter of coil
T Turn number of coil
P Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATE

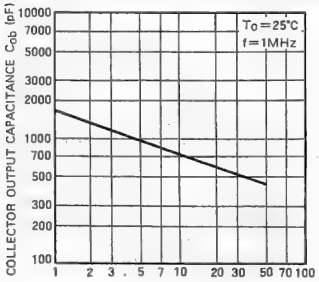
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



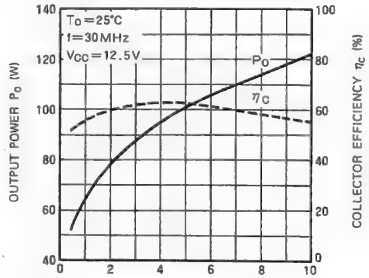
DC CURRENT GAIN VS. COLLECTOR CURRENT



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



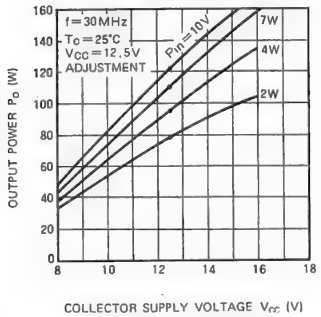
OUTPUT POWER COLLECTOR EFFICIENCY VS. INPUT POWER



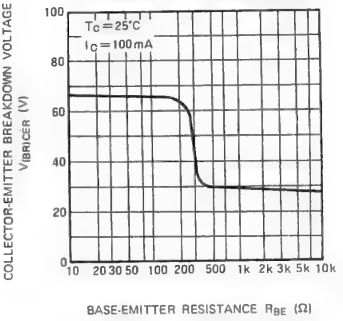
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

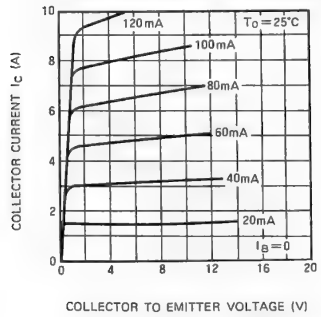
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



COLLECTOR CURRENT VS. COLLECTOR-TO-EMITTER VOLTAGE



2SC3241

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC3241 is a silicon NPN epitaxial planar type transistor specifically designed for high power amplifiers in HF band.

FEATURES

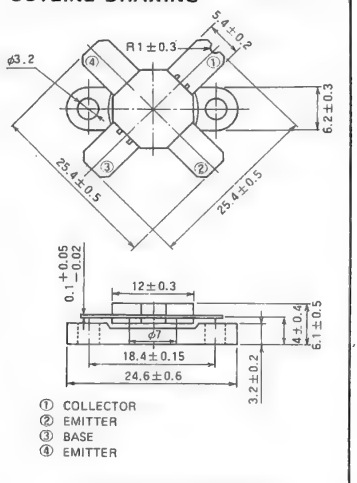
- High gain: $G_{pe} \geqq 12.3$dB
  @f = 30MHz, V_{CC} = 12.5V, P_{in} = 4W
- High ruggedness: Ability to withstand 20:1 load VSWR when operated at f = 30MHz, V_{CC} = 15.2V, P_O = 75W, T_c = 25°C.
- Emitter ballasted construction
- Low thermal resistance ceramic package with flange
- Input-output impedance: Z_{in} = 0.5 – j1.0(Ω), Z_{out} = 1.15 – j1.4(Ω) @f = 30MHz, V_{CC} = 12.5V, P_O = 75W

APPLICATION

Output stage of transmitter in HF band SSB mobile radio sets.

OUTLINE DRAWING

Dimensions in mm



NOTE. EMITTER ELECTRODES ARE CONNECTED WITH FLANGE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	20	V
I_C	Collector current		18	A
P_C	Collector dissipation	T_a = 25°C	7.5	W
		T_C = 25°C	180	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-a	Thermal resistance	Junction to ambient	20	°C/W
Rth-c		Junction to case	0.83	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 20mA, I_C = 0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 10mA, I_E = 0	50			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 100mA, R_{BE} = ∞	20			V
I_{CBO}	Collector cutoff current	V_{CE} = 25V, I_E = 0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB} = 2V, I_C = 0			4	mA
h_{FE}	DC forward current gain *	V_{CE} = 10V, I_C = 0.1A	10	50	180	—
P_O	Output power.	f = 30MHz, V_{CC} = 12.5V, P_{in} = 4W	75	85		W
η_C	Collector efficiency		55	65		%

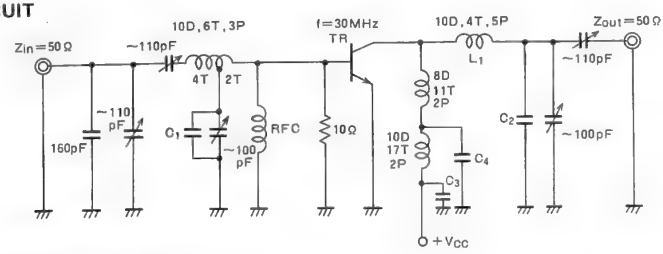
* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

2SC3241

NPN EPITAXIAL PLANAR TYPE

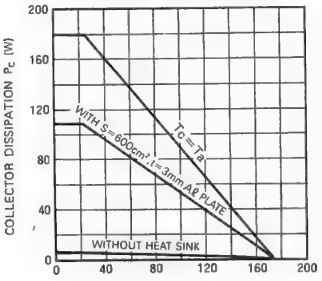
TEST CIRCUIT



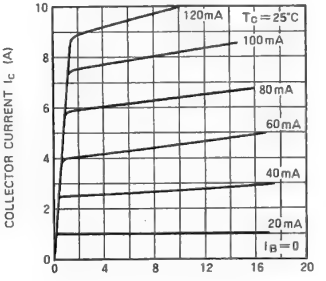
C_1: 160pF, 160pF, 82pF in parallel
C_2: 82pF, 82pF, 82pF in parallel
C_3: 100pF, 4700pF, 4700pF, 0.22μF, 0.22μF, 33μF, 330μF in parallel
C_4: 100pF, 220pF, 4700pF, 0.1μF, 330μF in parallel
RFC: 27 Turns 1φ enameled wire
NOTES: All coils but L_1 are made from 1.5φmm silver plated coper wire, L_1 is made from 2.3φmm copper wire.
D Inner diameter of coil
T Turn number of coil
P Pitch of coil
Dimension is milli-meter

TYPICAL PERFORMANCE DATA

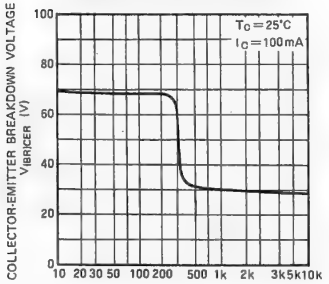
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



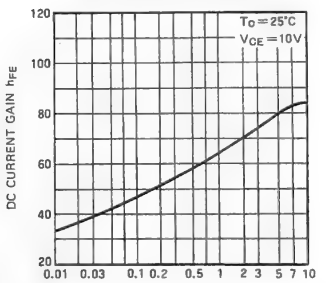
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

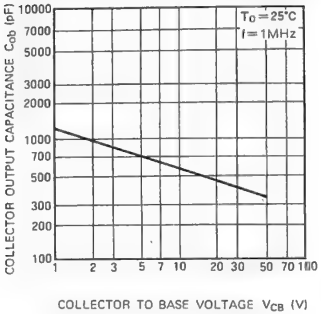


DC CURRENT GAIN VS. COLLECTOR CURRENT

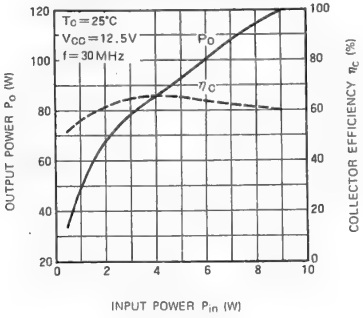


NPN EPITAXIAL PLANAR TYPE

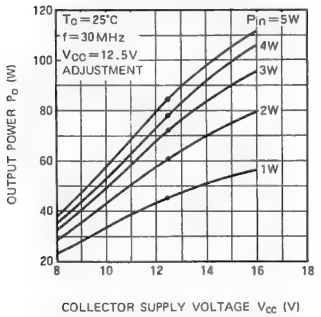
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC3379

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3379 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifier applications.

FEATURES

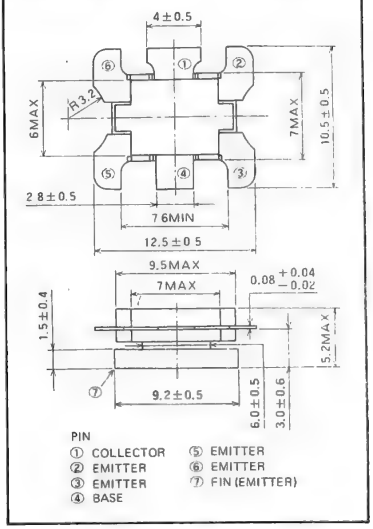
- High power gain: $G_{pe} \geqq 6.7$dB
  @$V_{CC}=7.2$V, f=520MHz, $P_{in}=0.6$W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC}=9$V, f=520MHz, $P_O=2.8$W.
- Flange type ceramic package.

APPLICATION

For output stage of 1～2W power amplifiers in UHF band portable type radio sets.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS ($T_C=25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		1.5	A
P_C	Collector dissipation	$T_C=25°C$	10	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-c	Thermal resistance	Junction to case	15	°C/W

ELECTRICAL CHARACTERISTICS ($T_C=25°C$)

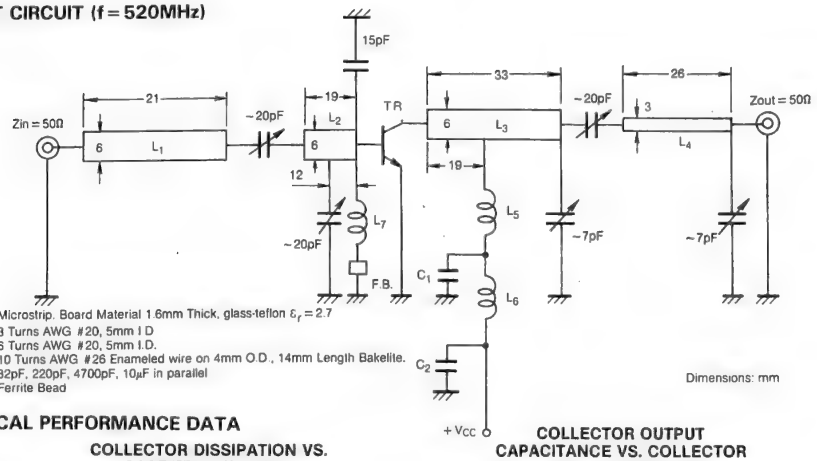
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E=1$mA, $I_C=0$	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C=10$mA, $I_E=0$	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C=10$mA, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cut-off current	$V_{CB}=10$V, $I_E=0$			300	μA
I_{EBO}	Emitter cut-off current	$V_{EB}=2$V, $I_C=0$			300	μA
h_{FE}	DC forward current gain*	$V_{CE}=5$V, $I_C=0.1$A	10	50	180	—
P_O	Power Output	$V_{CC}=7.2$V, $P_{in}=0.6$W, f=520MHz	2.8	3.2		W
η_C	Collector efficiency		55	60		%

* Note. Pulse test, $P_W=150\mu$s, duty 5%

2SC3379

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)

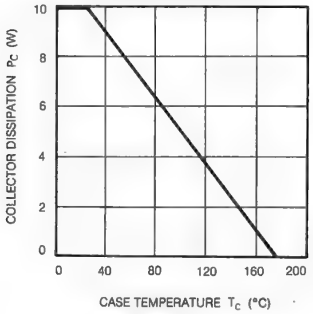


L_1~L_4: Microstrip. Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_5: 3 Turns AWG #20, 5mm I.D
L_6: 6 Turns AWG #20, 5mm I.D.
L_7: 10 Turns AWG #26 Enameled wire on 4mm O.D., 14mm Length Bakelite.
C_1,C_2: 82pF, 220pF, 4700pF, 10μF in parallel
F.B.: Ferrite Bead

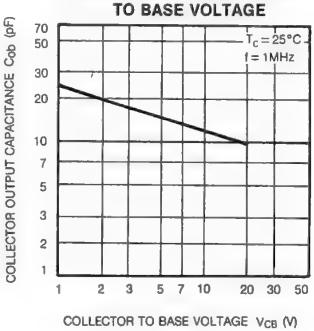
Dimensions: mm

TYPICAL PERFORMANCE DATA

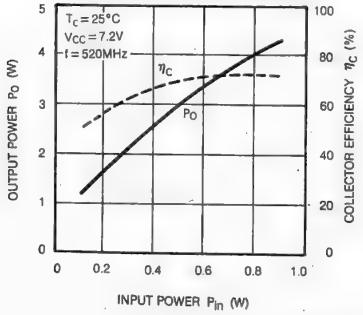
COLLECTOR DISSIPATION VS. CASE TEMPERATURE



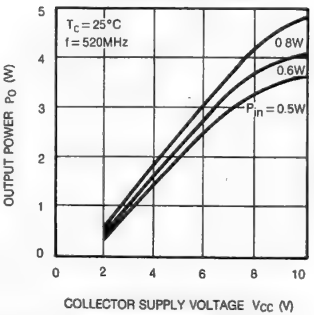
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



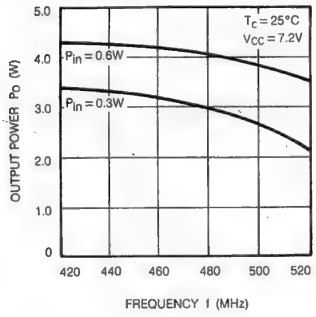
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



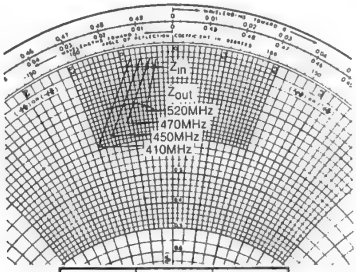
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

OUTPUT POWER VS. FREQUENCY



SERIES INPUT AND OUTPUT IMPEDANCE VS. FREQUENCY



f (MHz)	$\dot{Z}_{in}$ (Ω)	$\dot{Z}_{out}$ (Ω)
410	1.5 − j4.5	5.5 − j7.0
450	1.5 − j3.5	5.3 − j5.5
470	1.6 − j2.5	5.4 − j4.5
520	1.8 − j1.9	6.0 − j3.0
V_{CC} = 7.2V, P_O = 2.8W		

PRECAUTIONS FOR MOUNTING HIGH-FREQUENCY HIGH-OUTPUT TRANSISTOR FOR MOBILE RADIO EQUIPMENT

When mounting high-frequency, high-output transistors for mobile radio equipment (flange screw fastening part cut package), care should be taken to the following points.

1. When mounting the device to the heat sink, silicon compound should be applied to the heat sink and device heat radiating fin and apply the device to the heat sink using a proper fastening tool.
2. If the device is soldered directly to heat sink, excessive thermal stress will result in deteriorating the reliability. Do not use this mounting method.
3. Care should be taken, if the device is applied to the heat sink, the force of soldering the leads to the printed circuit board results in continual mechanical stress, deteriorating the reliability and performance of the system.
4. Refer to Mitsubishi's DATABOOK or manuals for transistors, small-signal diodes and integrated circuit modules for mounting and handling of the device.

2SC3404

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3404 is a silicon NPN epitaxial planar type transistor specifically designed for VHF power amplifier applications.

FEATURES

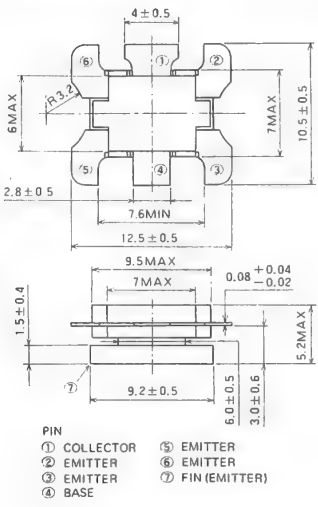
- High power gain: $G_{pe} \geqq 12.7$dB. @V_{CC}=7.2V, f=175MHz, P_{in}=80mW.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC}=9V, f=175MHz, P_O=1.5W, T_c=25°C.
- Flange type ceramic package.

APPLICATION

For output stage of 1W power amplifiers in VHF band portable type radio sets.

OUTLINE DRAWING

Dimensions in mm



PIN

① COLLECTOR ⑤ EMITTER
② EMITTER ⑥ EMITTER
③ EMITTER ⑦ FIN (EMITTER)
④ BASE

ABSOLUTE MAXIMUM RATINGS (T_c=25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_c=25°C	5	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C

ELECTRICAL CHARACTERISTICS (T_c=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cut off current	V_{CB}=10V, I_E=0			200	μA
I_{EBO}	Emitter cut off current	V_{EB}=2V, I_C=0			200	μA
h_{FE}	DC forward current gain *	V_{CE}=5V, I_C=0.1A	10	50	180	—
P_O	Power Output	V_{CC}=7.2V, Pin=80mW, f=175MHz	1.5	1.8		W
η_C	Collector efficiency		55	60		%

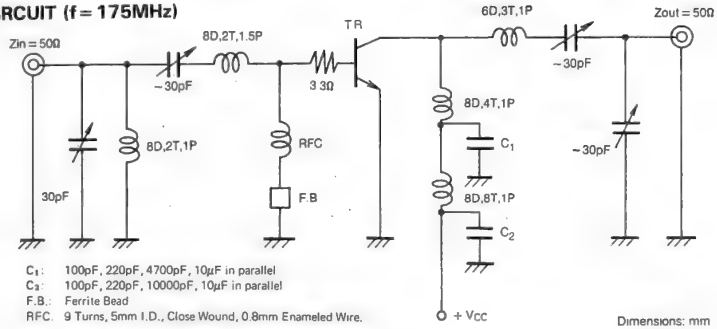
* Note. Pulse test, P_W=150μs, duty=5%

MITSUBISHI ELECTRIC

2SC3404

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 175MHz)



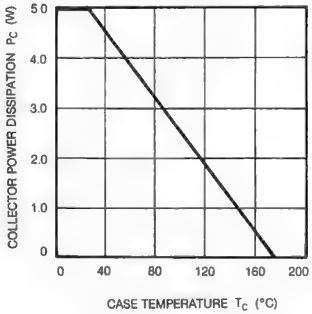
C_1: 100pF, 220pF, 4700pF, 10μF in parallel
C_2: 100pF, 220pF, 10000pF, 10μF in parallel
F.B.: Ferrite Bead
RFC: 9 Turns, 5mm I.D., Close Wound, 0.8mm Enameled Wire.

Note: 1.5mmϕ, Silvered Wire without FRC.
D: Inner diameter of coil, T: Turn number of coil, P: Pitch of coil

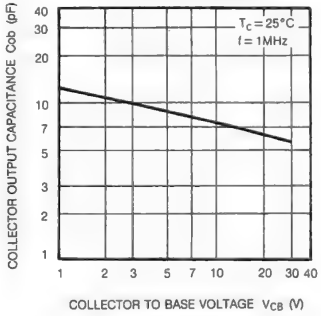
Dimensions: mm

TYPICAL PERFORMANCE DATA

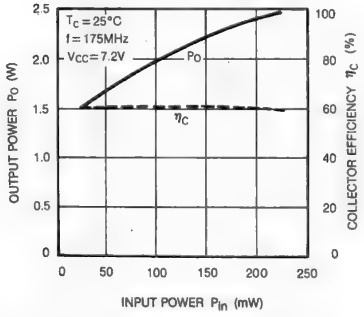
COLLECTOR POWER DISSIPATION VS. CASE TEMPERATURE



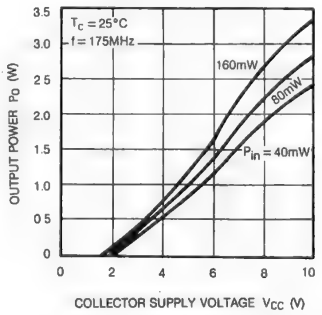
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



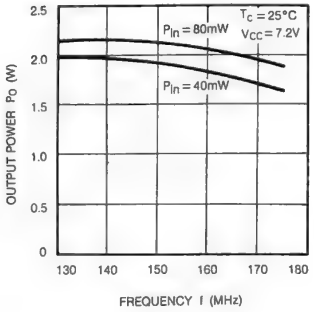
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



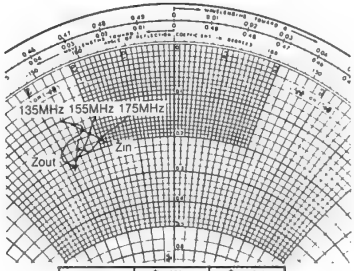
2SC3404

NPN EPITAXIAL PLANAR TYPE

OUTPUT POWER VS. FREQUENCY



INPUT/OUTPUT IMPEDANCE VS. FREQUENCY



f(MHz)	$Z_{in}(\Omega)$	$Z_{out}(\Omega)$
135	7.0−j11.1	11−j14.1
155	7.8−j10.5	10−j13.5
175	8.5−j9.8	9.3−j13
V_{CC} = 7.2V, P_O = 1.5W		

PRECAUTIONS FOR MOUNTING HIGH-FREQUENCY HIGH-OUTPUT TRANSISTOR FOR MOBILE RADIO EQUIPMENT

When mounting high-frequency, high-output transistors for mobile radio equipment (flange screw fastening part cut package), care should be taken to the following points.

1. When mounting the device to the heat sink, silicon compound should be applied to the heat sink and device heat radiating fin and apply the device to the heat sink using a proper fastening tool.
2. If the device is soldered directly to heat sink, excessive thermal stress will result in deteriorating the reliability. Do not use this mounting method.
3. Care should be taken, if the device is applied to the heat sink, the force of soldering the leads to the printed circuit board results in continual mechanical stress, deteriorating the reliability and performance of the system.
4. Refer to Mitsubishi's DATABOOK or manuals for transistors, small-signal diodes and integrated circuit modules for mounting and handling of the device.

MITSUBISHI ELECTRIC

2SC3628

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC3628 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

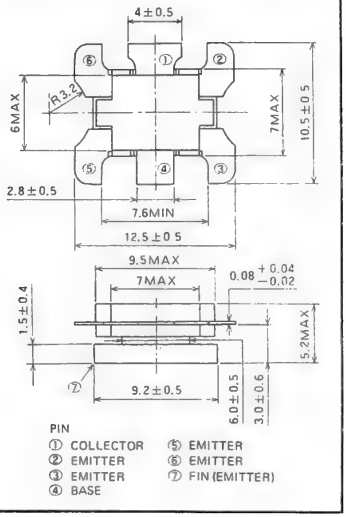
- High power gain: $G_{pe} \geqq 13.8$dB
  @V_{CC} = 13.5V, P_O = 6W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W, f = 175MHz.

APPLICATION

4 to 5 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



PIN

① COLLECTOR ⑤ EMITTER
② EMITTER ⑥ EMITTER
③ EMITTER ⑦ FIN (EMITTER)
④ BASE

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	Ta=25°C	2	W
		T_C=25°C	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	75	°C/W
Rth-c		Junction to case	7.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

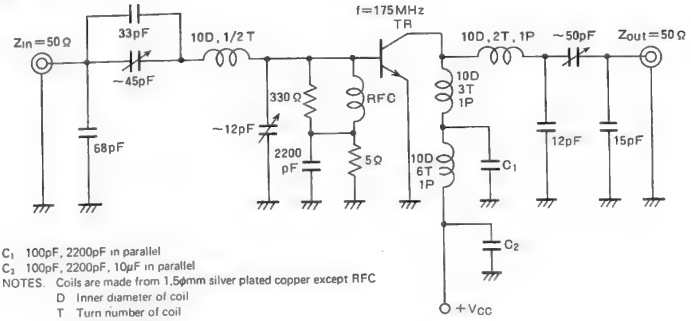
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_B=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.25W, f=175MHz	6	7.5		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

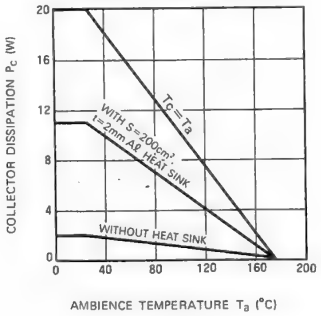
TEST CIRCUIT



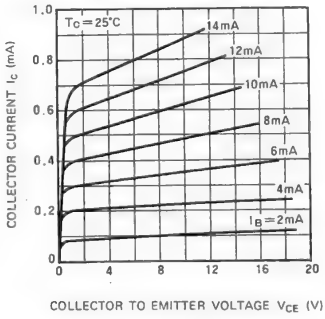
C_1 100pF, 2200pF in parallel
C_2 100pF, 2200pF, 10μF in parallel
NOTES. Coils are made from 1.5φmm silver plated copper except RFC
D Inner diameter of coil
T Turn number of coil
P Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATE

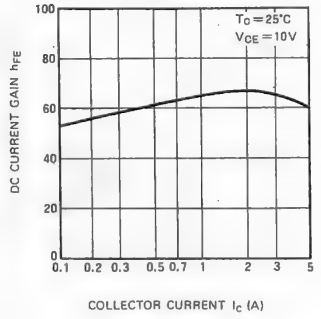
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



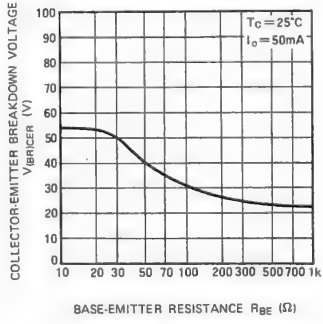
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT



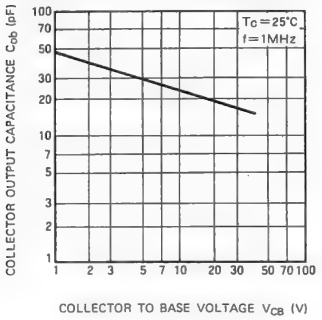
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



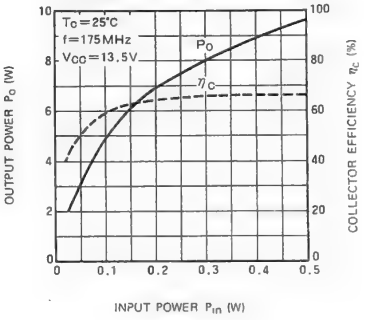
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

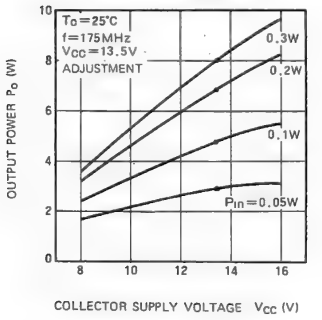
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



PRECAUTIONS FOR MOUNTING HIGH-FREQUENCY HIGH-OUTPUT TRANSISTOR FOR MOBILE RADIO EQUIPMENT

When mounting high-frequency, high-output transistors for mobile radio equipment (flange screw fastening part cut package), care should be taken to the following points.

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4. Refer to Mitsubishi's DATABOOK or manuals for transistors, small-signal diodes and integrated circuit modules for mounting and handling of the device.

2SC3629

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3629 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in UHF band 7.2 volts operation applications.

FEATURES

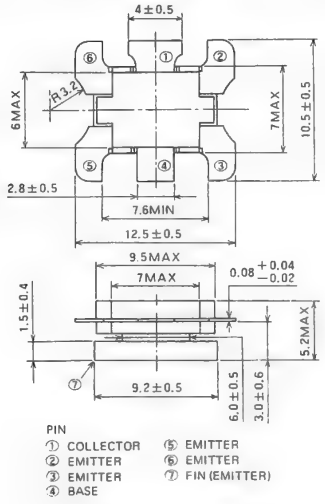
- High gain: $G_{pe} \geq 7.7$dB
  @V_{CC} = 7.2V, f = 520MHz, P_{in} = 0.2W
- Ability of withstanding more than 20:1 load VSWR when operated at f = 520MHz, V_{CC} = 9V, P_o = 1.2W, T_c = 25°C.
- Emitter ballasted construction.
- Flange type ceramic package.

APPLICATION

Output stage of 1W output mobile radio equipment in UHF band

OUTLINE DRAWING

Dimensions in mm



PIN

① COLLECTOR ⑤ EMITTER
② EMITTER ⑥ EMITTER
③ EMITTER ⑦ FIN (EMITTER)
④ BASE

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter		Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage		9	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_C=25°C	5	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55~+175	°C
R_{th-c}	Thermal resistance		30	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

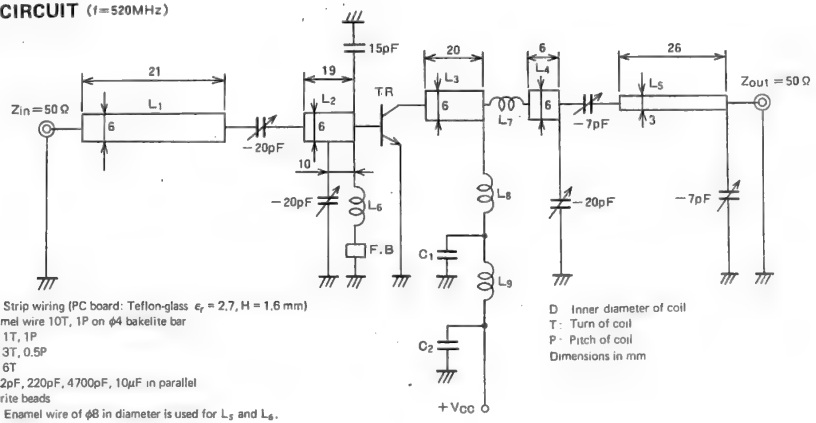
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_C=10mA, I_E=0	20			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_E=1mA, I_C=0	3.5			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=∞	9			V
I_{CBO}	Collector cutoff current	V_{CB}=10V, I_E=0			200	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			200	μA
h_{FE}	DC forward current gain *	V_{CE}=5V, I_C=0.1A	20	50	180	—
P_O	Output power	V_{CC}=7.2V, f=520MHz, Pin=0.2W	1.2	1.5		W
η_C	Collector efficiency		55	60		%

* Note. Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f=520MHz)

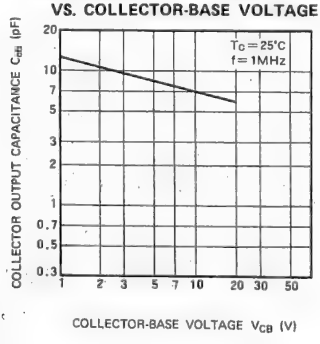


L_1~L_5 Strip wiring (PC board: Teflon-glass $\epsilon_r = 2.7$, H = 1.6 mm)
L_6: Enamel wire 10T, 1P on ϕ4 bakelite bar
L_7: 8D, 1T, 1P
L_8: 5D, 3T, 0.5P
L_9: 5D, 6T
L_1, L_3: 82pF, 220pF, 4700pF, 10μF in parallel
F.B.: Ferrite beads
NOTE: Enamel wire of ϕ8 in diameter is used for L_5 and L_6.

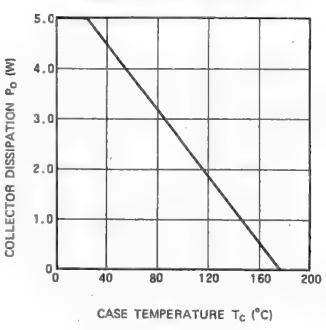
D: Inner diameter of coil
T: Turn of coil
P: Pitch of coil
Dimensions in mm

TYPICAL PERFORMANCE DATA

COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR-BASE VOLTAGE

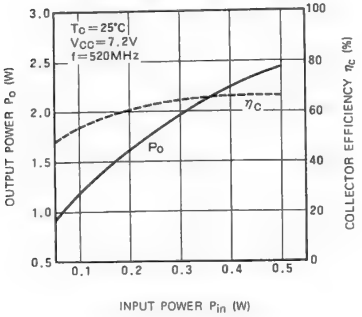


COLLECTOR-LOSS VS. AMBIENT TEMPERATURE

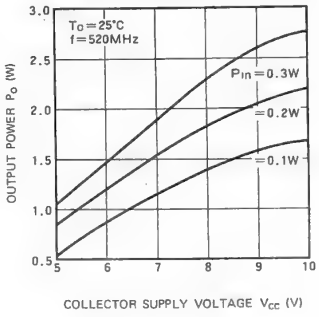


NPN EPITAXIAL PLANAR TYPE

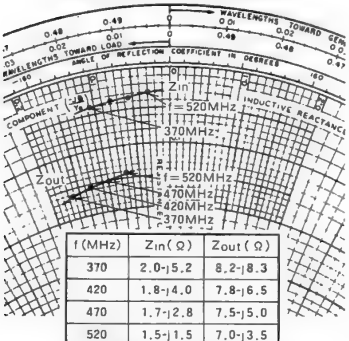
OUTPUT POWER, COLLECTOR LOSS VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE VARIATION



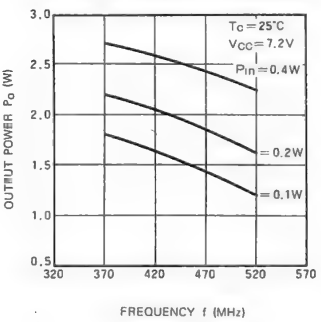
INPUT/OUTPUT IMPEDANCE VS. FREQUENCY



f(MHz)	Z_{in}(Ω)	Z_{out}(Ω)
370	2.0-j5.2	8.2-j8.3
420	1.8-j4.0	7.8-j6.5
470	1.7-j2.8	7.5-j5.0
520	1.5-j1.5	7.0-j3.5

CONDITIONS: V_{CC} = 7.2V, P_O = 1.5W

OUTPUT POWER VS. FREQUENCY



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2. If the device is soldered directly to heat sink, excessive thermal stress will result in deteriorating the reliability. Do not use this mounting method.
3. Care should be taken, if the device is applied to the heat sink, the force of soldering the leads to the printed circuit board results in continual mechanical stress, deteriorating the reliability and performance of the system.
4. Refer to Mitsubishi's DATABOOK or manuals for transistors, small-signal diodes and integrated circuit modules for mounting and handling of the device.

2SC3630

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3630 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifiers applications.

FEATURES

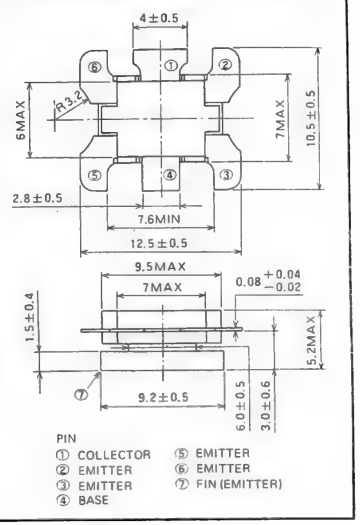
- High power gain: $G_{pe} \geqq 5.7$dB
  @V_{CC} = 12.5V, f = 520MHz, P_{in} = 0.8W
- Emitter ballasted construction
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at @V_{CC} = 15.2V, f = 520MHz, P_O = 3W.

APPLICATION

For drive stage and output stage of power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_C=25°C	10	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55 ~ +175	°C

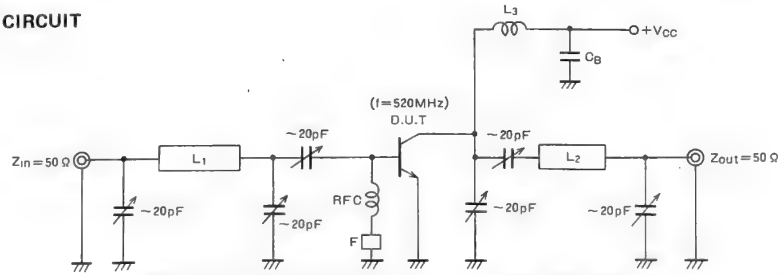
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			300	mA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			300	μA
h_{FE}	DC forward current gain *	V_{CB}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=0.8W, f=520MHz,	3	3.5		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

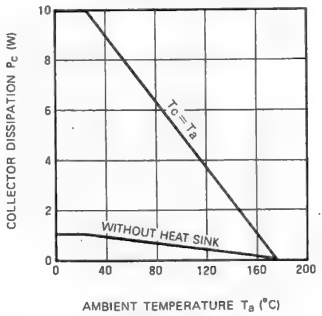


L_1 Width 3.5, length 25, thinkness 0.3 cupper plate
L_2 Width 3.5, length 17, thinkness 0.8 cupper plate
L_3 50, 2T, 1P, ϕ0.8 enameled wire
RFC 10, 5T, 0.5P ϕ0.8 enameled wire

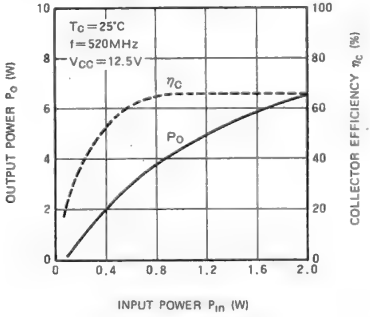
C_B : 150pF, 1500pF, 3.3μF inparallel
F : Ferrite bead
(Note) D Inner diameter T Turn numbers of coil
P Pitch of coil Dimensions mm

TYPICAL PERFORMANCE DATA

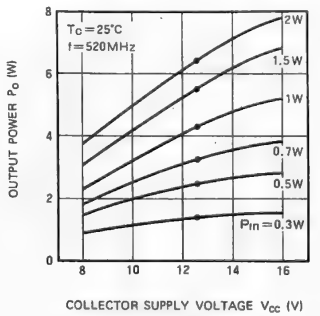
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS



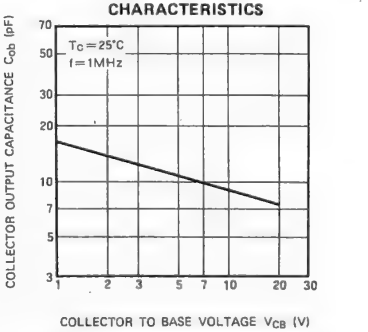
OUTPUT POWER COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



MITSUBISHI ELECTRIC

2SC3804

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3804 is a silicon NPN epitaxial planar-type transistor specifically designed for power amplifiers in the 800 ~ 900MHz band range.

FEATURES

- High gain, high efficiency
  $P_O \geqq 40W$, $G_{pe} \geqq 3.0dB$, $\eta_C = 50\%$ (MIN)
  @f = 850MHz, $V_{CC} = 13.5V$, $P_{in} = 20W$
- Emitter ballasted by diffusion resistance.
- Gold metalization of transistor die for good reliability.
- The ability withstand infinite VSWR when operated at $P_O = 40W$, $V_{CC} = 15.2V$.
- High Input-Impedance Transistor (HI^2T); internal input matching network.
- Common-base type.

APPLICATION

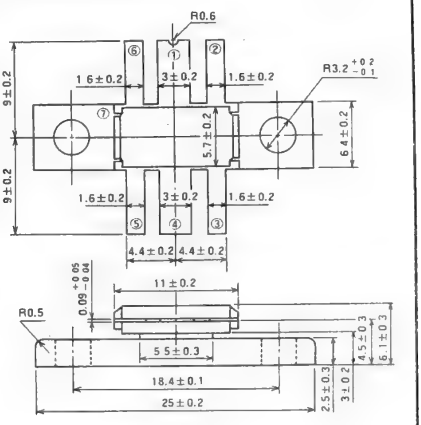
For RF power amplifiers in the 800 ~ 900MHz band range, especially suitable for mobile radio applications.

SERIES EQUIVALENT INPUT/OUTPUT IMPEDANCE

$Z_{in} = 1.4 - j2.4\ (\Omega)$, $Z_{out} = 2.5 + j1.0\ (\Omega)$ @f = 850MHz, $V_{CC} = 13.5V$, $P_O = 40W$

OUTLINE DRAWING

Dimensions in mm



PIN

① COLLECTOR
② BASE
③ BASE
④ EMITTER
⑤ BASE
⑥ BASE
⑦ FLANGE (BASE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector-to-base voltage		35	V
V_{EBO}	Emitter-to-base voltage		3	V
V_{CEO}	Collector-to-emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		12	A
P_C	Collector dissipation	T_C=25°C	100	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

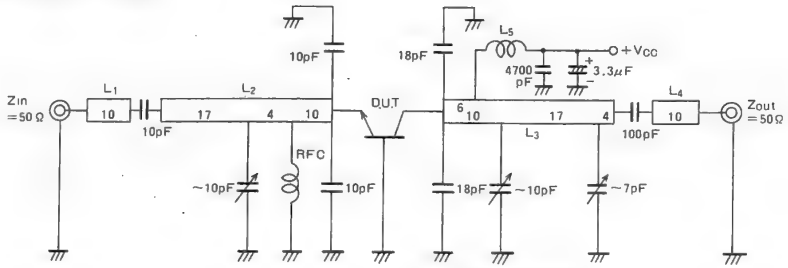
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter-to-base breakdown voltage	I_E=10mA, I_C=0	3			V
$V_{(BR)CBO}$	Collector-to-base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector-to-emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			5	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=1A	10	40	120	—
P_O	Power output	V_{DD}=13.5V, P_{in}=20W, f=850MHz	40	35		W
η_C	Collector efficiency		50	55		%

* Note: Pulse test, P_W = 150μs, duty = 5%

2SC3804

NPN EPITAXIAL PLANAR TYPE

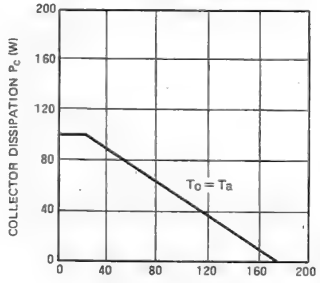
TEST CIRCUIT (f = 850MHz)



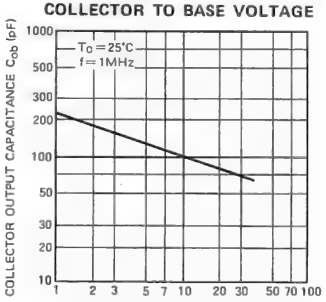
$L_1 \sim L_4$: W = 3mm STRIP-LINE
L_5: 5D, 1T, 0P, 1.0φ SILVER PLATED COPPER WIRE
RFC: 5D, 1/2T, 1.0φ SILVER PLATED COPPER WIRE
NOTE BOARD MATERIAL-GLASS TEFLON. εs = 2.6, t = 0.8mm
D: INNER DIAMETER. T: TURN NUMBER. P: PITCH.
ALL DIMENSIONS IN mm.

TYPICAL PERFORMANCE DATA

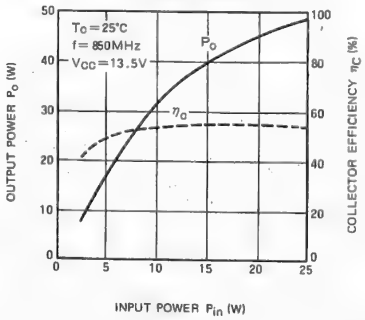
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



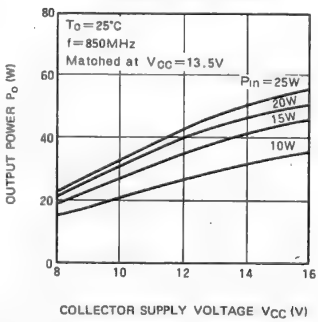
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER

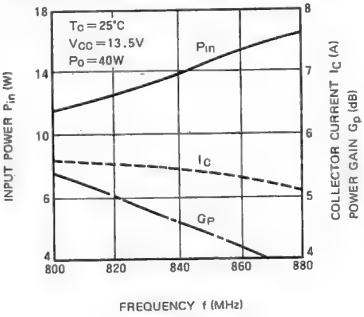


OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

INPUT POWER, POWER GAIN, COLLECTOR CURRENT VS. FREQUENCY



RECOMMENDATION AND PRECAUTION ON THE USE OF DEVICE

1. MOUNTING METHOD TO THE HEAT SINK

Mounting the device to the heat sink should be given a special consideration as follows.

Optimum distance between the centers of the installing bolt holes is 18.3 mm, and optimum diameter of this hole is 3.5 mm.

Apply a thin coat of thermal compound to every portions relating with the thermal conduction such as the flange bottom, the installing bolt holes etc.

Optimum tightening torque is 5 to 6 kg-cm.

Prevent the upward stress to the leads.

Soldering should be conducted at the temperature of 250°C or lower and within 8 seconds.

2. OPERATING JUNCTION TEMPERATURE Tj(op)

When designing the circuit, the thermal design should be performed so that the operating junction temperature Ti(op) will be 130°C or lower even under the ambinet temperature of 60°C.

3. BASE TO EMITTER BIAS RESISTANCE

Where a bias resistor is inserted between the base and the emitter for the devise to operate in AB or C class, make the resistance's value as small as possible, (normally 5Ω or less). If the value is excessibly large, reverse voltage will be applied to the emitter-base junction by this resistor when the drive power is large, and the emitter-base junction may be brought to avalanche breakdown by the drive power, resulting in the degradation of h_{FE} and output power.

4. GUARANTEED CHARACTERISTICS

All the graphic characteristics illustrated in this catalog are typical examples. The characteristics of individual device specified in Maximum ratings and Electrical characteristics are guaranteed under specified conditions.

5. DISPOSAL OF UNUSED DEVICES

The ceramic body of this transistor contains beryllium oxide (BeO). The dust or the vapor of BeO's porcelain is hazardous if inhaled, so don't crush, grind or abrade this portion. And don't treat the package in the high temperature (over 800°C) damp atmoshere.

2SC3908

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3908 is a silicon NPN epitaxial planar type transistor designed for HF power amplifiers applications.

FEATURES

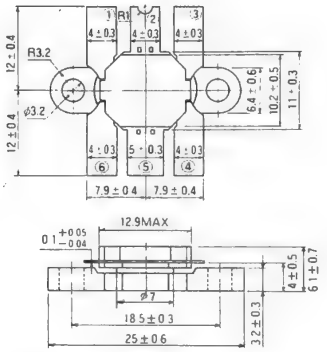
- High power gain: $G_{pe} \geqq 11.5$dB
  @P_O = 100W, f = 30MHz, V_{CC} = 12.5V
- The ability withstand infinite VSWR when operated at f = 30MHz. V_{CC} = 12.5V, P_O = 100W.
- Flange type ceramic package.

APPLICATION

For output stage of 100 ~ 150W power amplifiers in HF band SSB mobile radio sets. (Push-pull operation)

OUTLINE DRAWING

Dimensions in mm



PIN
① EMITTER (FLANGE)
② COLLECTOR
③ EMITTER (FLANGE)
④ EMITTER (FLANGE)
⑤ BASE
⑥ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter		Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage		20	V
I_C	Collector current		22	A
P_C	Collector dissipation	T_a=25°C	7.8	W
		T_C=25°C	200	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance		19.2	°C/W
Rth-c			0.75	°C/W

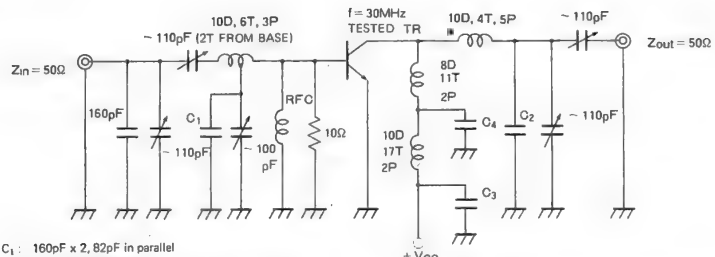
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_C=20mA, I_E=0	50			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_E=20mA, I_C=0	5			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	20			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			5	mA
h_{FE}	DC forward current gain	V_{CE}=10V, I_C=1A	10	50	180	—
P_O	Output power	f=30MHz, V_{CC}=12.5V, P_{in}=7W	100	110		W
η_C	Collector efficiency		55	60		%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

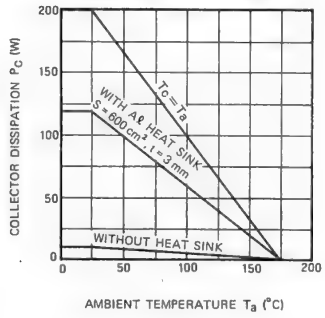


C_1 : 160pF x 2, 82pF in parallel
C_2 : 82pF x 3 in parallel
C_3 : 100pF, 4700pF x 2, 0.22μF x 2,,33μF, 330μF in parallel
C_4 : 100pF, 220pF, 4700pF, 0.1μF, 330μF in parallel
RFC : 27T on a dust core (V_8T-10-8-6), 1φ enamel dense wiring

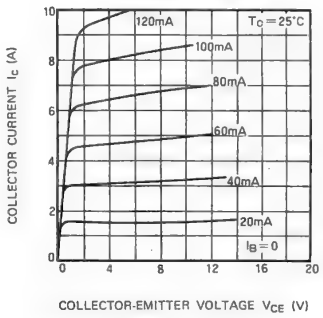
NOTES 1.5φ silver plated copper wire coil, 2.3φ in diameter for those marked by *
D : Inner diameter of coil
T : Coil Turn
P : Coil pitch
Coil dimensions in mm

TYPICAL PERFORMANCE DATA

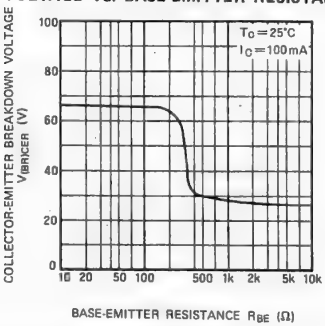
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



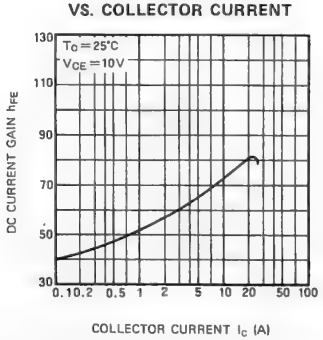
OUTPUT CHARACTRISTIC, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

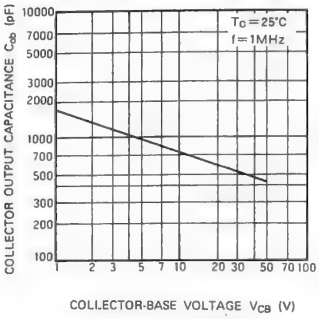


DC CURRENT GAIN VS. COLLECTOR CURRENT

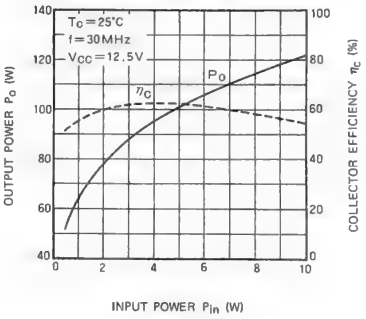


NPN EPITAXIAL PLANAR TYPE

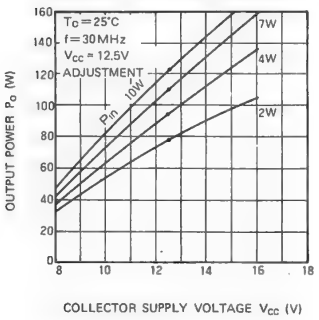
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR-BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER, COLLECTOR SUPPLY VOLTAGE VARIATION



MITSUBISHI ELECTRIC

PRECAUTIONS FOR USE

Mitsubishi transistors have high reliability and good performance, as they are designed and manufactured under strict quality control. However, the characteristics and reliability of semiconductor devices are greatly affected by usage conditions if inappropriate thermal, mechanical or electrical stresses are applied.

To keep high reliability and obtain good performance when using Mitsubishi transistors, the following important points should be noted before use:

1. OPERATING JUNCTION TEMPERATURE $T_{j\,(OP)}$

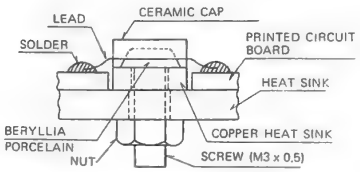
When designing a heat sink, keep the operating junction temperature $T_{j(OP)}$ below 130°C at ambient temperature T_a = 60°C.

2. BASE-EMITTER EXTERNALLY CONNECTED RESISTOR

If a base-emitter bias resistor is inserted for AB class or C class amplifiers, the resistance value should be minimized. (Normally less than 5Ω to 10Ω.) If this value is too large, exciting input is increased and reverse bias current is applied to base and emitter and the emitter-base junction breaks down because of this exciting input, thus reducing h_{FE} and output power.

3. MOUNTING METHOD

(1) Use fastening screws of M3 x 0.5.
(2) Fastening torque of screw is recommended as 5 to 6 kg-cm.
(3) Application of compound: Thermal compound to get good heat sinking should be applied to the bottom of the flange, fastening screws, as well as inside flange holes and holes of module's fin.
(4) The distance between the centers of screw holes of heat sink fins should be 18.3 ± 0.2 mm and the diameter of holes should be 3.5 mm.
(5) When mounting the device to the substrate, do not apply upper tensile force to the leads.
(6) The temperature of lead soldering should be less than 250°C and shorter than 8 seconds.



4. GUARANTEED CHARACTERISTICS

All the graphic characteristics illustrated in this catalog are typical examples. The characteristics of individual devices as specified in the tables of absolute maximum ratings and electrical characteristics are guaranteed under the specified conditions.

5. PROCESSING OF DEFECTIVE PRODUCT OR DISCARDED PRODUCT

Beryllia porcelain is used in the transistor package. Dust or vapor of beryllia porcelain is extremely harmful to you. Do not cut, crack, or carve the device or do not process the device at high temperature (more than 800°C) in humid atmosphere.

2SC4167

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC4167 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifiers applications.

FEATURES

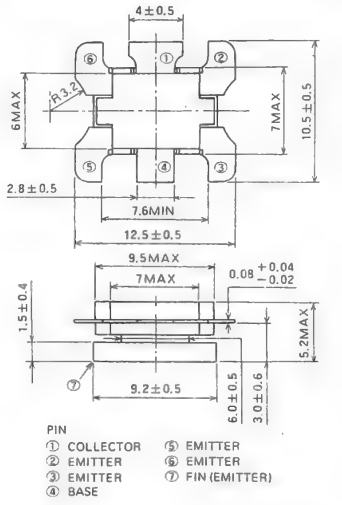
- High power gain: $G_{pe} \geqq 7.6$dB
  @V_{CC} = 12.5V, f = 520MHz, P_{in} = 1.2W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, f = 520MHz, P_O = 7W.
- Flange type ceramic package.
- $Z_{in} = 2.2 + j3.1\Omega$,
  $Z_{out} = 6 - j1.0\Omega$ @V_{CC} = 12.5V, f = 520MHz, P_O = 7W.

APPLICATION

For output stage of 5W power amplifiers and drive stage of higher power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C = 25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	T_C = 25°C	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C)

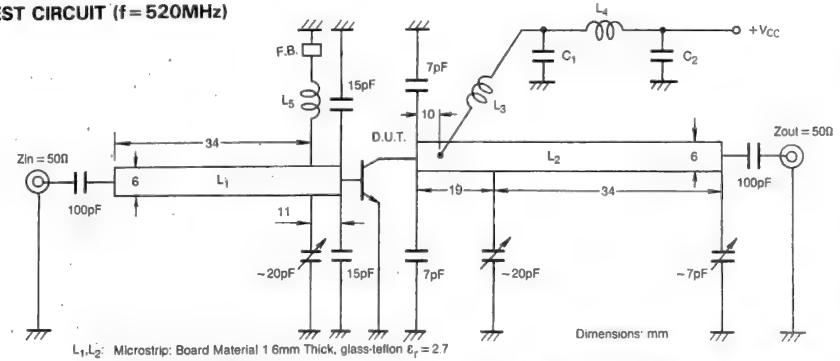
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 5mA, I_C = 0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 10mA, I_E = 0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 50mA, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cut off current	V_{CB} = 15V, I_E = 0			500	μA
I_{EBO}	Emitter cut off current	V_{EB} = 3V, I_C = 0			500	μA
h_{FE}	DC forward current gain *	V_{CE} = 10V, I_C = 0.1A	10	50	180	—
P_O	Power Output	V_{CC} = 12.5V, P_{in} = 1.2W, f = 520MHz	7	8		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)

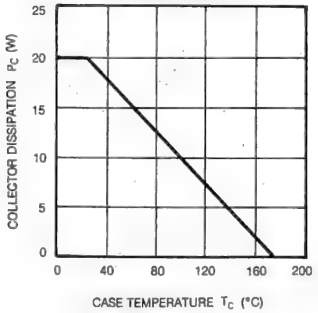


L_1,L_2: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_3: 3 Turns AWG #20, 5mm I.D.
L_4: 6 Turns AWG #20, 5mm I.D.
L_5: 10 Turns AWG #26 Enameled Wire on 4mm O.D., 14mm Length Bakelite

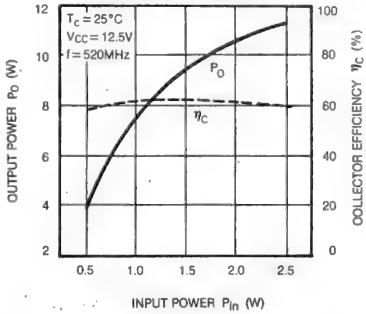
F.B.: Ferrite Bead
C_1: 82pF, 220pF, 4700pF, 10μF in parallel
C_2: 82pF, 220pF, 10μF in parallel

TYPICAL PERFORMANCE DATA

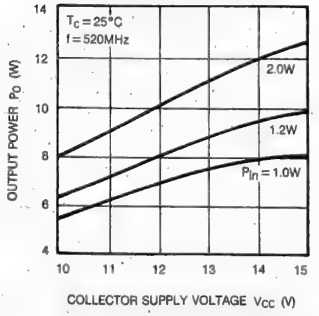
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



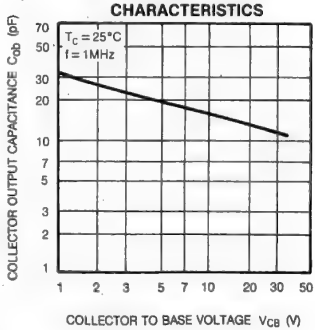
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



2SC4240

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC4240 is a silicon NPN epitaxial planar type transistor specifically designed for VHF power amplifier applications.

FEATURES

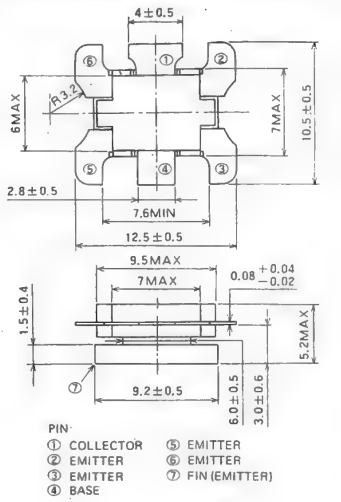
- High power gain: $G_{pe} \geqq 13$dB.
  @V_{CC}=7.2V, f=175MHz, P_{in}=0.3W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC}=9V, f=175MHz, P_O=6.0W.
- Flange type ceramic package.
- Z_{in}=1.5−j1.3Ω, Z_{out}=5.0−j1.2Ω
  @V_{CC}=7.2V, f=175MHz, P_O=6.0W.

APPLICATION

For output stage of 5W power amplifiers in VHF band portable type radio sets.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Symbol	Parmeter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		3	A
P_C	Collector dissipation	T_C=25°C	20	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C)

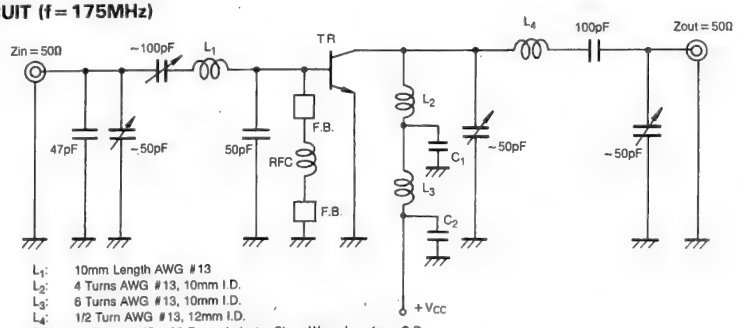
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cut-off current	V_{CB}=10V, I_E=0			500	μA
I_{EBO}	Emitter cut-off current	V_{EB}=2V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=5V, I_C=0.1A	20	50	180	—
P_O	Power Output	V_{CC}=7.2V, Pin=0.3W, f=175MHz	6	7		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, P_W=150μs, duty=5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

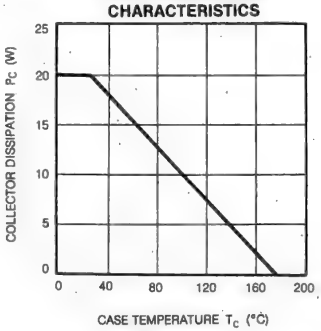
TEST CIRCUIT (f = 175MHz)



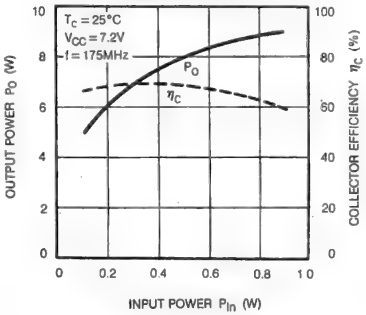
L_1: 10mm Length AWG #13
L_2: 4 Turns AWG #13, 10mm I.D.
L_3: 6 Turns AWG #13, 10mm I.D.
L_4: 1/2 Turn AWG #13, 12mm I.D.
RFC: 40 Turns AWG #32 Enameled wire Close Wound on 4mm O.D 14mm Length Bakelite.
C_1: 220pF, 1000pF, 4700pF, 10μF in parallel.
C_2: 220pF, 1000pF, 4700pF, 10μF in parallel.

TYPICAL PERFORMANCE DATA

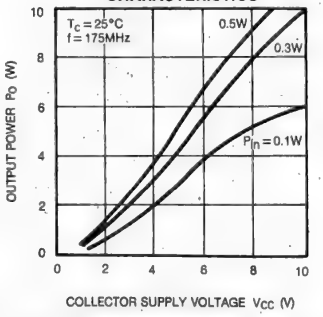
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



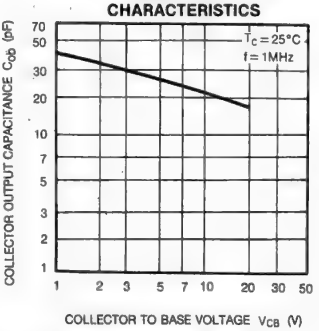
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS.



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



2SC4524

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC4524 is a silicon NPN epitaxial planar type transistor specifically designed for RF power amplifiers applications in 1.65GHz.

FEATURES

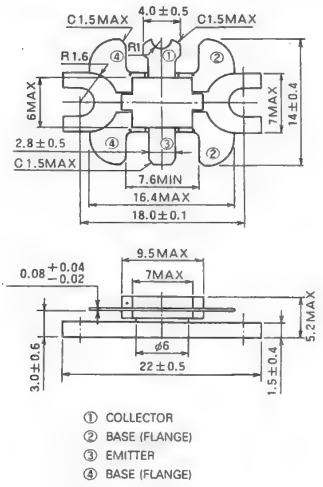
- High power gain: $G_{pb} \geqq 5.4$dB, $P_o = 7$W @$V_{CC} = 28$V, f = 1.65GHz.
- High ruggedness: Ability to withstand 16:1 load VSWR when operated at $V_{CC} = 28$V, f = 1.65GHz, $P_o = 7$W.
- Emitter ballasted construction. Gold metalization die.

APPLICATION

For pre-amplifier stage of 50W, 1.6GHz – 1.65GHz, 28V, amamplifier.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② BASE (FLANGE)
③ EMITTER
④ BASE (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		4	V
V_{CES}	Collector to emitter voltage	$R_{BE}=0$	45	V
I_C	Collector current		2.5	A
P_C	Collector dissipation	$T_C=25$°C	30	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−50∼+175	°C
Rth-c	Thermal resistance	Junction to case	5.0	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

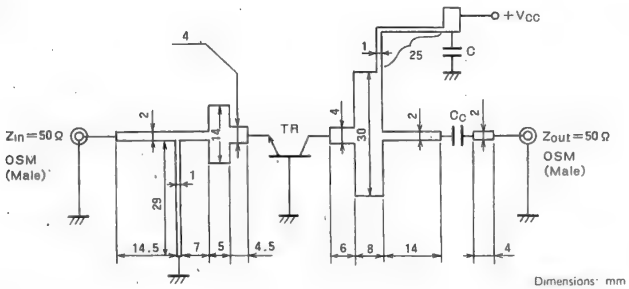
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E=5$mA, $I_C=0$	4.0			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C=10$mA, $I_E=0$	50			V
$V_{(BR)CES}$	Collector to emitter breakdown voltage	$I_C=10$mA, $R_{EB}=0$	45			V
I_{CBO}	Collector cutoff current	$V_{CB}=25$V, $I_E=0$			1	mA
h_{FE}	DC forward current gain *	$V_{CE}=5$V, $I_C=1$A	10	50	180	—
P_O	Output power	$V_{CC}=28$V, f=1.65GHz, $P_{in}=2$W	7	10		W
η_C	Collector efficiency		45	50		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

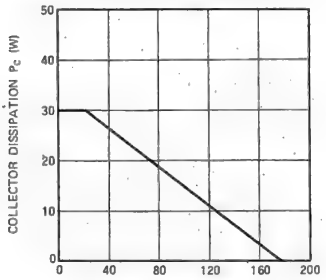
TEST CIRCUIT



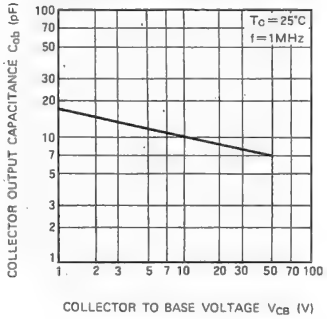
Cc 50pF Chip capacita
C 50pF, 2200pF, 22000pF, 100μF in parallel
Board Material: Teflon-Glass t = 0.8 mm

TYPICAL PERFORMANCE DATE

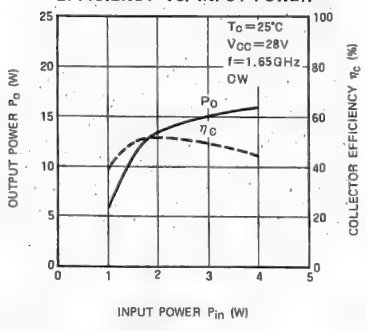
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



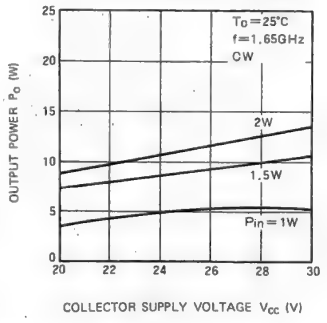
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



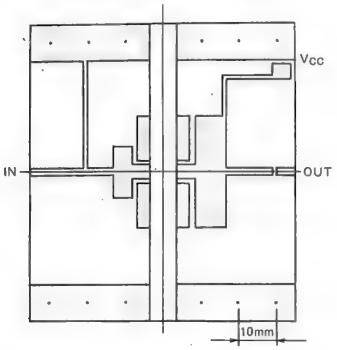
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



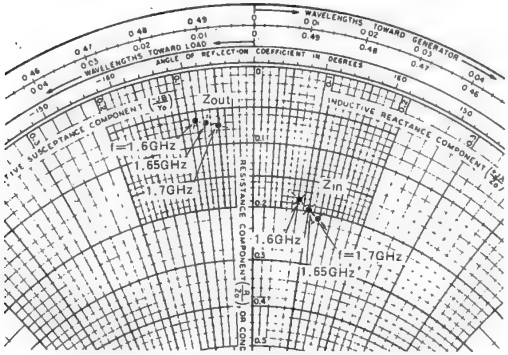
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



CIRCUIT PATTERN LAYOUT



INPUT AND OUTPUT SERIES IMPEDANCE



f	Zin (Ω)	Zout (Ω)
1.6GHz	9.2+j4.0	3.2−j3.0
1.65GHz	9.8+j4.9	3.4−j3.3
1.7GHz	10.3+j6	3.7−j2.5

CONDITIONS:
V_{CC}=28V, f=1.6−1.7GHz,
P_O=7W CW

1. Special Instructions for Flange-Mounted Ceramic-Encapsulated High-Frequency High-Output Transistor Installation

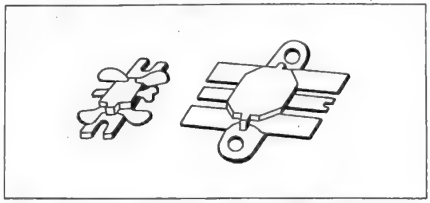


Fig. 1 Flange-Mounted Ceramic Encapsulated High-Frequency High-Output Transistor

When the flange-mounted ceramic-encapsulated transistor shown in Fig. 1 is mounted on a heat sink plate, be sure to follow the special instructions below, after referring to Fig. 2.

(1) Be sure to use M3 x 0.5 screws for mounting the transistor.

(2) Be sure that the fastening screws are tightened to a torque of 5 to 6kg.cm.

(3) Application of lubricants (grease): Apply lubricant (grease) to all heat-conducting components, including the bottom of the flange, the fastening screws, inside the flange holes, and the holes of the heat sink fins. Particular care is required in applying the lubricant compound. Be the more careful the greater the higher the operating level of the device concerned is.

(4) Be sure that the screw hole centers of the heat sink fins are spaced at a distance of 18.3 ± 0.2mm and that the holes have a diameter of 3.5mm.

(5) Take care to ensure that when the device is mounted on to the substrate, no tensile stress acting in the upward direction is applied to the leads. Mount so that the printed circuit board is positioned slightly lower than the bottom of the leads.

(6) After the device has been mounted, solder the leads so that the soldering temperature is below 250°C and that the time used for soldering one lead is within 8 seconds.

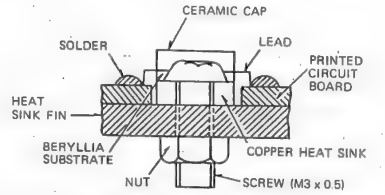


Fig. 2 Installation Procedure for Flange-Mounted Ceramic-Encapsulated Transistor with Printed Pattern on the Upper Surface

2. Precautions for Use of the Device

(1) Operating Junction Temperature (Tjop)

Be sure to design the circuit so that the operating junction temperature Tjop will not exceed 130°C at ambient temperature conditions within 60°C.

(2) Base-Emitter Externally Connected Resistor

If a bias resistor is inserted between the base and emitter for AB class amplifiers, be sure to design the bias circuit so that the resistance remains below 5 ohm. If this resistance value is excessively high, the exciting input will be increased, accordingly and a reverse bias current will be applied between the base and the emitter, thereby iving rise to the problem of a reduction in h_{FE} and a drop in the output power.

(3) Guaranteed Characteristics

All graphic characteristics illustrated in this catalog are typical examples. The characteristics for the individual devices are guaranteed under the specified conditions laid down with respect to the absolute maximum ratings and electrical characteristics.

3. Disposal of Defective or Discarded Products

All types of resin-encapsulated and ceramic-encapsulated high-frequency high-output transistors as well as some metal-encapsulated high-frequency high-output transistors use beryllia porcelain. The inhalation of beryllia dust and/or vapors can be extremely dangerous to the human body. It is therefore essential not to attempt to break, crush, cut, or dispose of these devices at high temperatures (above 800°C) in a moisture-containing atmosphere.

2SC4525

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC4525 is a silicon NPN epitaxial planar type transistor specifically designed for RF power amplifiers applications in 1.65GHz.

FEATURES

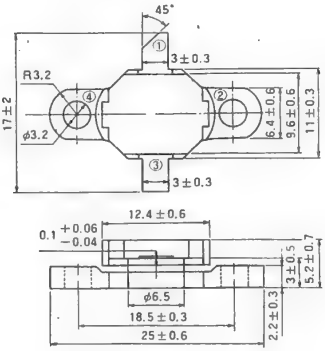
- High power gain: $G_{pb} \geqq 6.0$dB, $P_O = 20$W @$V_{CC} = 28$V, f = 1.65GHz.
- High ruggedness: Ability to withstand 16:1 load VSWR when operated at $V_{CC} = 28$V, f = 1.65 GHz, $P_O = 20$W.
- Emitter ballasted construction. Gold metalization die.

APPLICATION

For drive-amplifier stage of 50W, 1.6 ~ 1.65GHz amplifier.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② BASE
③ EMITTER
④ BASE

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		4.0	V
V_{CES}	Collector to emitter voltage	$R_{BE}=0$	45	V
I_C	Collector current		5.0	A
P_C	Collector dissipation	T_C=25°C	60	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-c	Thermal resistance	Junction to case	2.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

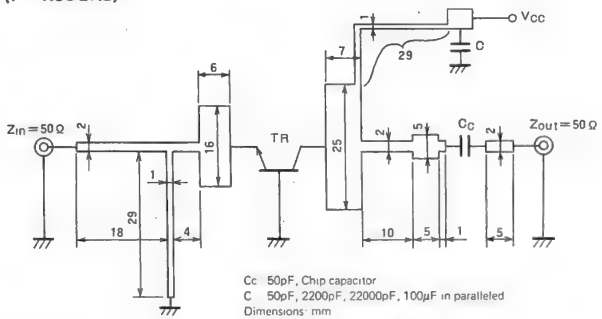
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4.0			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	50			V
$V_{(BR)CES}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=0	45			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			2	mA
h_{FE}	DC forward current gain *	V_{CE}=5V, I_C=5A	10	50	180	—
P_O	Output power	V_{CC}=28V, f=1.65GHz, P_{in}=5W	20	25		W
η_C	Collector efficiency		40	45		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

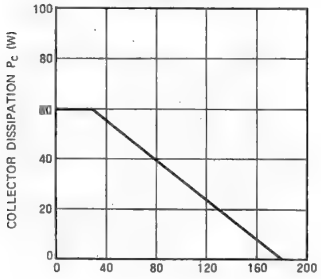
TEST CIRCUIT (f = 1.65GHz)



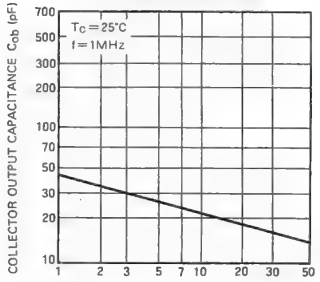
Cc 50pF, Chip capacitor
C 50pF, 2200pF, 22000pF, 100μF in paralleled
Dimensions: mm
Board material Teflon-Grass 0.8 mm

TYPICAL PERFORMANCE DATE

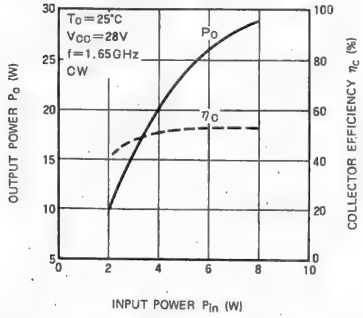
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



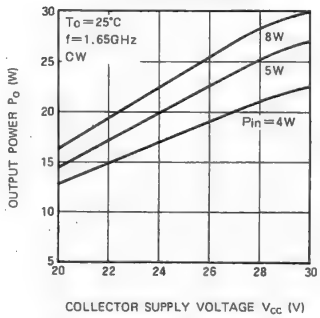
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS

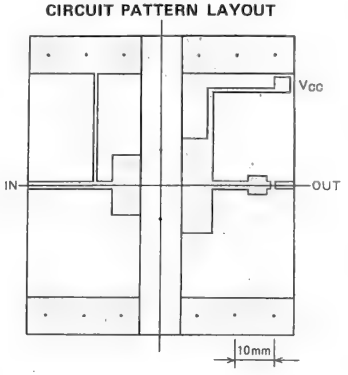


OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS

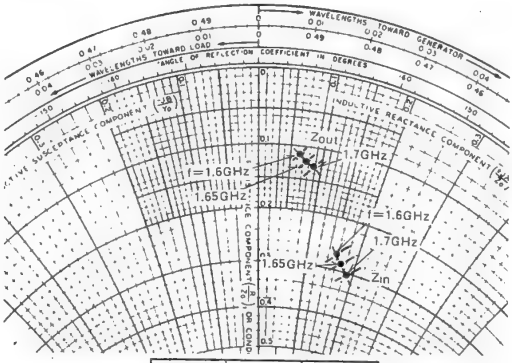


NPN EPITAXIAL PLANAR TYPE

CIRCUIT PATTERN LAYOUT



INPUT AND OUTPUT SERIES IMPEDANCE



f	Zin(Ω)	Zout(Ω)
1.6GHz	13.5+j8.0	5.6+j3.2
1.65GHz	14.5+j8.5	6.0+j3.8
1.7GHz	15.2+j9.2	6.5+j4.5

CONDITIONS:
V_{CC}=28V, f=1.6~1.7GHz,
P_O=20W CW

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

1. Special Instructions for Flange-Mounted Ceramic-Encapsulated High-Frequency High-Output Transistor Installation

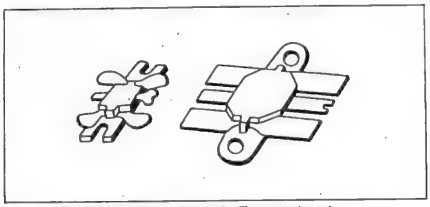


Fig. 1 Flange-Mounted Ceramic Encapsulated High-Frequency High-Output Transistor

When the flange-mounted ceramic-encapsulated transistor shown in Fig. 1 is mounted on a heat sink plate, be sure to follow the special instructions below, after referring to Fig. 2.

(1) Be sure to use M3 x 0.5 screws for mounting the transistor.

(2) Be sure that the fastening screws are tightened to a torque of 5 to 6kg.cm.

(3) Application of lubricants (grease): Apply lubricant (grease) to all heat-conducting components, including the bottom of the flange, the fastening screws, inside the flange holes, and the holes of the heat sink fins. Particular care is required in applying the lubricant compound. Be the more careful the greater the higher the operating level of the device concerned is.

(4) Be sure that the screw hole centers of the heat sink fins are spaced at a distance of 18.3 ± 0.2mm and that the holes have a diameter of 3.5mm.

(5) Take care to ensure that when the device is mounted on to the substrate, no tensile stress acting in the upward direction is applied to the leads. Mount so that the printed circuit board is positioned slightly lower than the bottom of the leads.

(6) After the device has been mounted, solder the leads so that the soldering temperature is below 250°C and that the time used for soldering one lead is within 8 seconds.

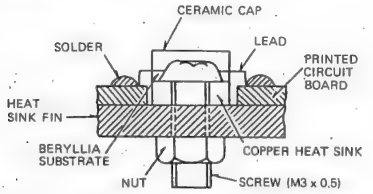


Fig. 2 Installation Procedure for Flange-Mounted Ceramic-Encapsulated Transistor with Printed Pattern on the Upper Surface

2. Precautions for Use of the Device

(1) Operating Junction Temperature (Tjop)

Be sure to design the circuit so that the operating junction temperature Tjop will not exceed 130°C at ambient temperature conditions within 60°C.

(2) Base-Emitter Externally Connected Resistor

If a bias resistor is inserted between the base and emitter for AB class amplifiers, be sure to design the bias circuit so that the resistance remains below 5 ohm. If this resistance value is excessively high, the exciting input will be increased, accordingly and a reverse bias current will be applied between the base and the emitter, thereby iving rise to the problem of a reduction in h_{FE} and a drop in the output power.

(3) Guaranteed Characteristics

All graphic characteristics illustrated in this catalog are typical examples. The characteristics for the individual devices are guaranteed under the specified conditions laid down with respect to the absolute maximum ratings and electrical characteristics.

3. Disposal of Defective or Discarded Products

All types of resin-encapsulated and ceramic-encapsulated high-frequency high-output transistors as well as some metal-encapsulated high-frequency high-output transistors use beryllia porcelain. The inhalation of beryllia dust and/or vapors can be extremely dangerous to the human body. It is therefore essential not to attempt to break, crush, cut, or dispose of these devices at high temperatures (above 800°C) in a moisture-containing atmosphere.

2SC4526

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC4526 is a silicon NPN epitaxial planar type transistor specifically designed for RF power amplifier applications in 1.65GHz.

FEATURES

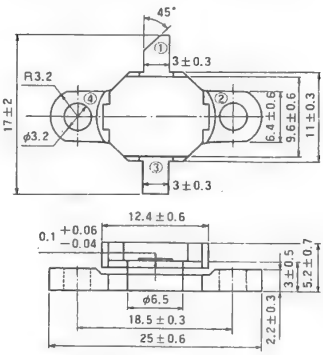
- High power gain: $G_{pb} \geqq 4.5$dB, P_o = 28W @V_{CC} = 28V, f = 1.65GHz.
- High ruggedness: Ability to withstand 16:1 load VSWR when operated at V_{CC} = 28V, f = 1.65 GHz, P_o = 28W.
- Emitter ballasted construction. Gold metalization die.

APPLICATION

For final stage (parallel or push-pull operation) of 50W, 1.6 ~ 1.65GHz, 28V, amplifier.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② BASE
③ EMITTER
④ BASE

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		4	V
V_{CES}	Collector to emitter voltage	R_{BE} = 0	45	V
I_C	Collector current		7.5	A
P_C	Collector dissipation	T_C = 25°C	90	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-c	Thermal resistance	Junction to case	1.7	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

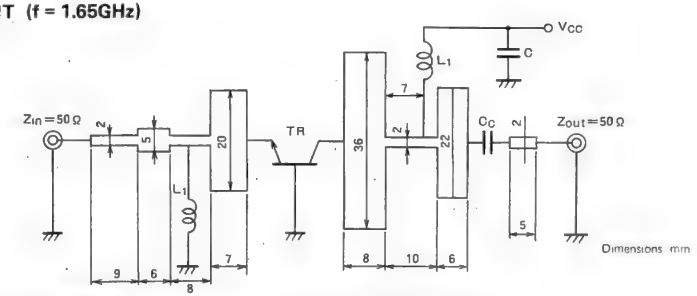
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4.0			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	50			V
$V_{(BR)CES}$	Collector to emitter breakdown voltage	I_C=10mA, R_{EB}=0	45			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			3	mA
h_{FE}	DC forward current gain *	V_{CE}=5V, I_C=6A	10	50	180	—
P_O	Output power	V_{CC}=28V, f=1.65GHz, P_{in}=10W	28	32		W
η_C	Collector efficiency		40	45		%

* Note. Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 1.65GHz)

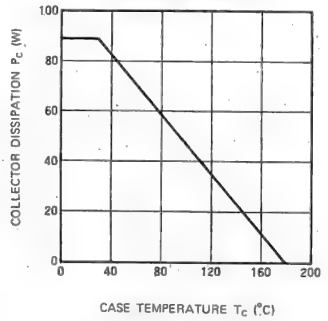


Cc. 50pF Chip capacitance
C . 50pF, 2200pF, 22000pF, 100μF in paralleled
L_1. O.D. AWG #20, 29 mm
L_2. O.D. AWG #20, 29 mm

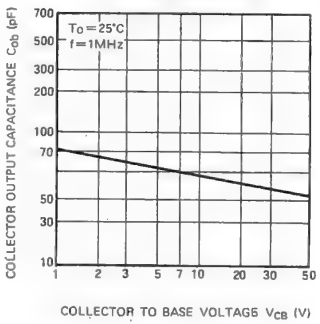
Board material: Teflon-Grass 0.8 mm

TYPICAL PERFORMANCE DATE

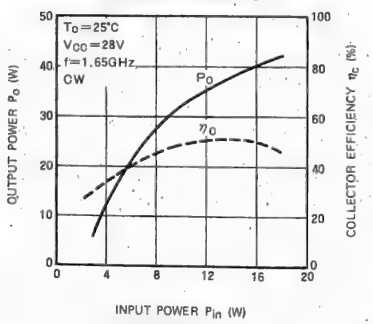
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



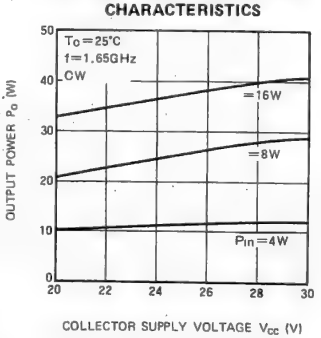
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS

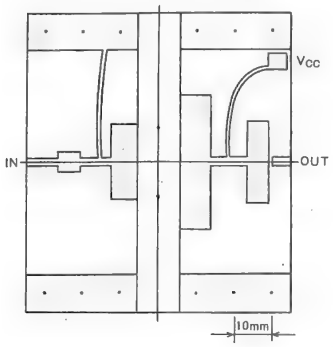


OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS

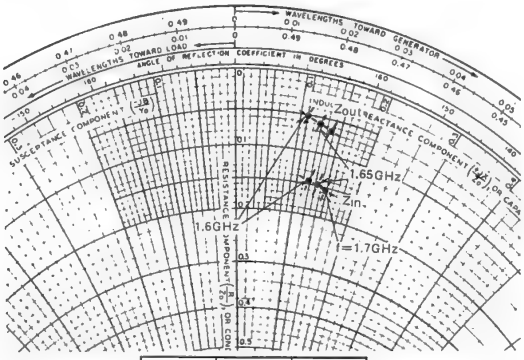


NPN EPITAXIAL PLANAR TYPE

CIRCUIT PATTERN LAYOUT



INPUT AND OUTPUT SERIES IMPEDANCE



f	Zin (Ω)	Zout (Ω)
1.6GHz	7.1+j6.0	2.6+j5.1
1.65GHz	7.4+j6.6	3.0+j6.0
1.7GHz	7.9+j7.2	3.5+j6.8

CONDITIONS
V_{CC}=28V, f=1.6−1.7GHz,
P_O=28W

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

1. Special Instructions for Flange-Mounted Ceramic-Encapsulated High-Frequency High-Output Transistor Installation

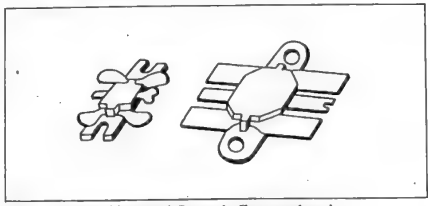


Fig. 1 Flange-Mounted Ceramic Encapsulated High-Frequency High-Output Transistor

When the flange-mounted ceramic-encapsulated transistor shown in Fig. 1 is mounted on a heat sink plate, be sure to follow the special instructions below, after referring to Fig. 2.

(1) Be sure to use M3 x 0.5 screws for mounting the transistor.
(2) Be sure that the fastening screws are tightened to a torque of 5 to 6kg.cm.
(3) Application of lubricants (grease): Apply lubricant (grease) to all heat-conducting components, including the bottom of the flange, the fastening screws, inside the flange holes, and the holes of the heat sink fins. Particular care is required in applying the lubricant compound. Be the more careful the greater the higher the operating level of the device concerned is.
(4) Be sure that the screw hole centers of the heat sink fins are spaced at a distance of 18.3 ± 0.2mm and that the holes have a diameter of 3.5mm.
(5) Take care to ensure that when the device is mounted on to the substrate, no tensile stress acting in the upward direction is applied to the leads. Mount so that the printed circuit board is positioned slightly lower than the bottom of the leads.
(6) After the device has been mounted, solder the leads so that the soldering temperature is below 250°C and that the time used for soldering one lead is within 8 seconds.

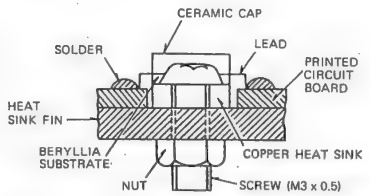


Fig. 2 Installation Procedure for Flange-Mounted Ceramic-Encapsulated Transistor with Printed Pattern on the Upper Surface

2. Precautions for Use of the Device

(1) Operating Junction Temperature (Tjop)

Be sure to design the circuit so that the operating junction temperature Tjop will not exceed 130°C at ambient temperature conditions within 60°C.

(2) Base-Emitter Externally Connected Resistor

If a bias resistor is inserted between the base and emitter for AB class amplifiers, be sure to design the bias circuit so that the resistance remains below 5 ohm. If this resistance value is excessively high, the exciting input will be increased, accordingly and a reverse bias current will be applied between the base and the emitter, thereby iving rise to the problem of a reduction in h_{FE} and a drop in the output power.

(3) Guaranteed Characteristics

All graphic characteristics illustrated in this catalog are typical examples. The characteristics for the individual devices are guaranteed under the specified conditions laid down with respect to the absolute maximum ratings and electrical characteristics.

3. Disposal of Defective or Discarded Products

All types of resin-encapsulated and ceramic-encapsulated high-frequency high-output transistors as well as some metal-encapsulated high-frequency high-output transistors use beryllia porcelain. The inhalation of beryllia dust and/or vapors can be extremely dangerous to the human body. It is therefore essential not to attempt to break, crush, cut, or dispose of these devices at high temperatures (above 800°C) in a moisture-containing atmosphere.

2SC4624

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC4624 is a silicon NPN epitaxial planar type transistor specifically designed for RF power amplifiers in 800~900 MHz band range.

FEATURES

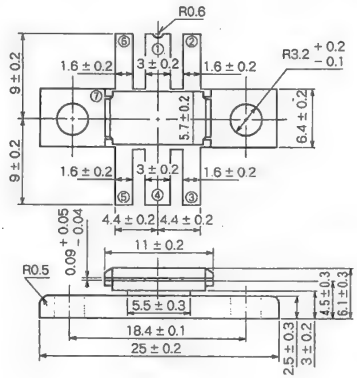
- High power gain : $G_{pe} \geq 4.7$dB, $P_o \geq 45$W @ $V_{CC} = 12.5$V, f = 900MHz, $P_{in} = 15$W
- Emitter ballasted construction.
- High ruggedness : Ability to withstand 20 : 1 load VSWR when operated at $V_{CC} = 15.2$V, $P_o = 45$W, f = 900MHz.
- High reliability due to gold metalization die.
- Flange type ceramic package.
- Common emitter configuraion.

APPLICATIONS

RF power amplifiers in 800~900MHz band range, especially suitable for radio applications.

OUTLINE DRAWING

Dimension in mm



PIN :
①COLLECTOR ⑤EMITTER
②EMITTER ⑥EMITTER
③EMITTER ⑦FLANGE (EMITTER)
④BASE

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$℃ unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector-base voltage		35	V
V_{EBO}	Emitter-base voltage		2.5	V
V_{CES}	Collector-emitter voltage	$R_{BE} = \infty$	16	V
I_C	Collector current		15	A
P_C	Collector dissipation	$T_C = 25$℃	110	W
T_j	Junction temperature		+175	℃
T_{stg}	Storage temperature range		−55~175	℃
$R_{th\text{-}c}$	Thermal resistance	Junction to case	1.36	W/℃

ELECTRICAL CHARACTERISTICS ($T_C = 25$℃ unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter-base breakdown voltage	$I_E = 10$mA, $I_C = 0$	2.5	–	–	V
$V_{(BR)CBO}$	Collector-base breakdown voltage	$I_C = 10$mA, $I_E = 0$	35	–	–	V
$V_{(BR)CEO}$	Collector-emitter breakdown voltage	$I_C = 100$mA, $R_{BE} = \infty$	16	–	–	V
I_{CBO}	Collector cutoff current	$V_{CB} = 15$V, $I_E = 0$	–	–	5000	μA
I_{EBO}	Emitter cutoff current	$V_{EB} = 2$V, $I_C = 0$	–		5000	μA
h_{FE}	DC forward current gain *	$V_{CE} = 10$V, $I_C = 1$A	10	50	180	–
P_o	Output power	$V_{CC} = 12.5$V, $P_{in} = 15$W, f = 900MHz	45	50	–	W
η_C	Colletor efficiency		45	50	–	%

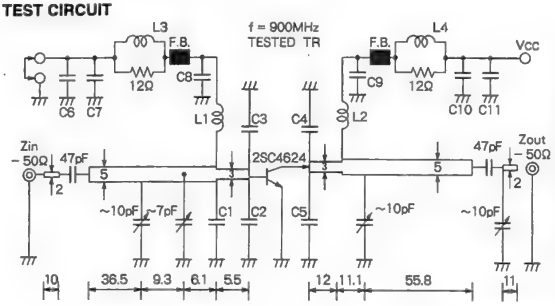
* Note : Pulse test, PW = 150μs, duty 5%

MITSUBISHI ELECTRIC

2SC4624

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT



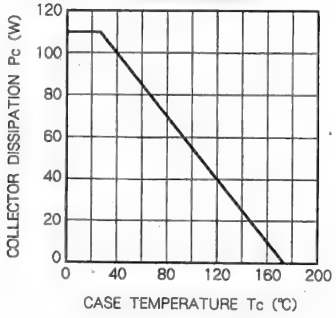
C1 : 5pF
C2 : 18pF
C3 : 18pF
C4 : 12pF
C5 : 15pF
C6 : 470pF
C7 : 22000pF
C8 : 100pF
C9 : 100pF
C10 : 22000pF
C11 : 470pF, 100 μF in parallel
L1 : 10D, 2T, 1P (# 15 AWG Silver plated)
L2 : 10D, 1T, 2P (# 15 AWG Silver plated)
L3 : 6D, 9T, Close-wound (# 20 AWG Enamel)
L4 : 6D, 9T, Close-wound (# 20 AWG Enamel)

Board Meterial : Tefron-glass, $h = 0.8$mm, $\varepsilon_r = 2.7$

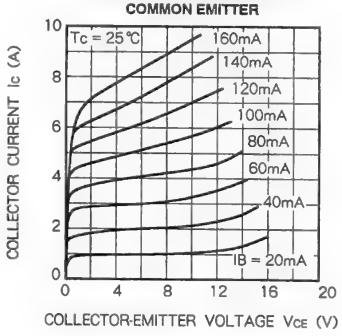
Dimensios : mms

TYPICAL PERFORMANCE DATA

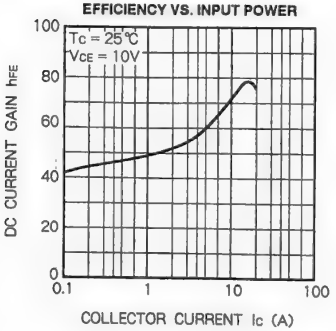
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



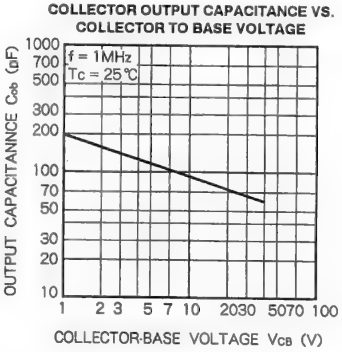
OUTPUT CHARACTERISTICS, COMMON EMITTER



OUTPUT POWER·COLLECTOR EFFICIENCY VS. INPUT POWER



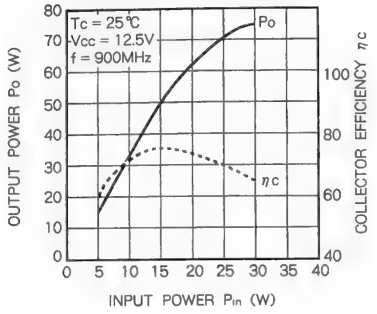
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



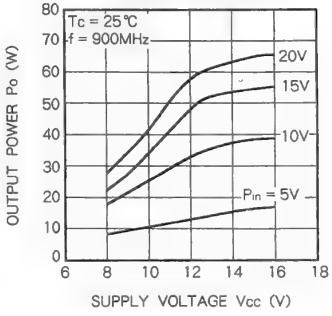
2SC4624

NPN EPITAXIAL PLANAR TYPE

OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER

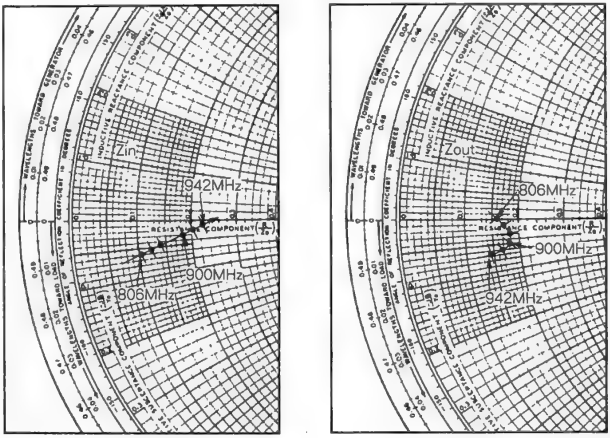


OUTPUT POWER, COLLECTOR SUPPLY VOLTAGE



INPUT AND OUTPUT SERIES IMPEDANCE VS. FREQUENCY CHARACTERISTICS

Zo = 10 Ω



f (GHz)	Zin (Ω)	Zout (Ω)
806	1.05 – j0.60	1.63 – j0.00
840	1.20 – j0.55	1.72 – j0.01
870	1.40 – j0.50	1.90 – j0.30
900	1.80 – j0.30	1.85 – j0.45
920	2.00 – j0.20	1.70 – j0.58
942	2.20 – j0.15	1.50 – j0.62
CONDITIONS : Vcc = 12.5V, Po = 45W		

MITSUBISHI ELECTRIC

2SC4838

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC4838 is a silicon NPN epitaxial planar type transistor specifically designed for RF power amplifiers in 1.65GHz.

FEATURES

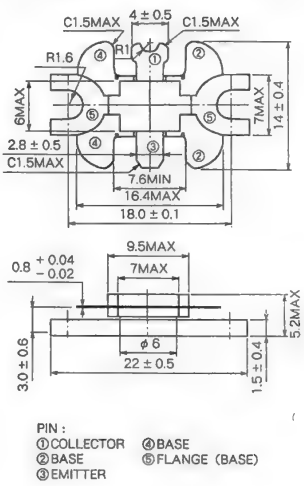
- High power gain : $G_{pb} \geqq 9.3$dB, $P_o \geqq 6$W @ $V_{CC} = 28$V, $f = 1.65$GHz, $P_{in} = 0.7$W
- Emitter ballasted construction.
- High reggedness : Ability to withstand 16 : 1 load VSWR when operated at $V_{CC} = 28$V, $P_o = 6$W, $f = 1.65$GHz.
- High reliability due to gold metalization die.
- Flange type ceramic package.
- Common base configuraion.

APPLICATIONS

For pre-amplifier stage of 50W, 1.65GHz, 28V.

OUTLINE DRAWING

Dimension in mm



PIN :
①COLLECTOR ④BASE
②BASE ⑤FLANGE (BASE)
③EMITTER

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$℃ unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector-base voltage		50	V
V_{EBO}	Emitter-base voltage		4	V
V_{CES}	Collector-emitter voltage	$R_{BE} = 0$	45	V
I_C	Collector current		2	A
P_C	Collector dissipation		17.5	W
T_j	Junction temperature		+175	℃
T_{stg}	Storage temperature range		−55~175	℃

ELECTRICAL CHARACTERISTICS ($T_C = 25$℃ unless otherwise noted)

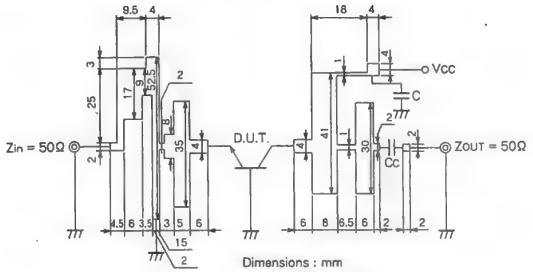
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter-base breakdown voltage	$I_E = 5$mA, $I_C = 0$	4.0	–	–	V
$V_{(BR)CBO}$	Collector-base breakdown voltage	$I_C = 10$mA, $I_E = 0$	50	–	–	V
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$I_C = 10$mA, $R_{BE} = 0$	45	–	–	V
I_{CBO}	Collector cutoff current	$V_{CB} = 25$V, $I_E = 0$	–	–	1000	μA
h_{FE}	DC forward current gain *	$V_{CE} = 5$V, $I_C = 1$A	10	50	180	–
P_o	Output power	$V_{CC} = 28$V, $P_{in} = 0.7$W, $f = 1.65$GHz	6.0	7.0	–	W
η_C	Colletor efficiency		45	50	–	%

* Note : Pulse test, PW = 150μs, duty 5%

2SC4838

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f=1.65GHz)

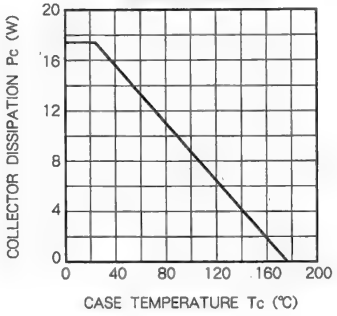


Dimensions : mm

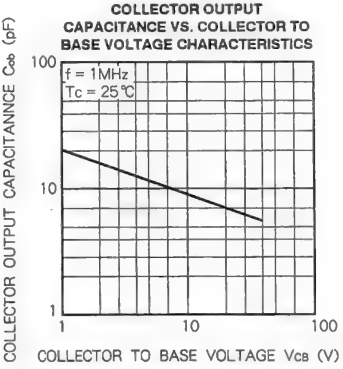
Cc : 47pF Chip capacita
C : 49pF, 2200pF, 22000pF, 100 μ F
Board Material : Tefron-Glass h = 0.8mm

TYPICAL PERFORMANCE DATA

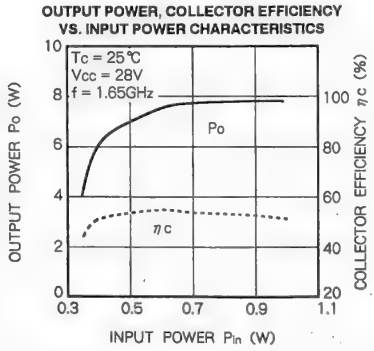
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



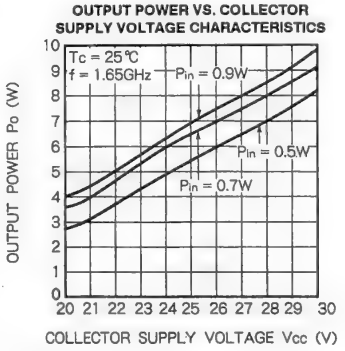
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS

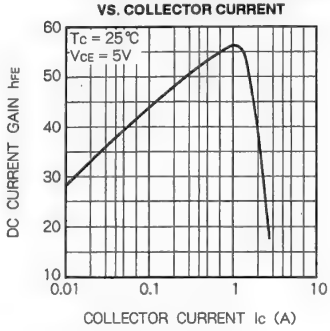


OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



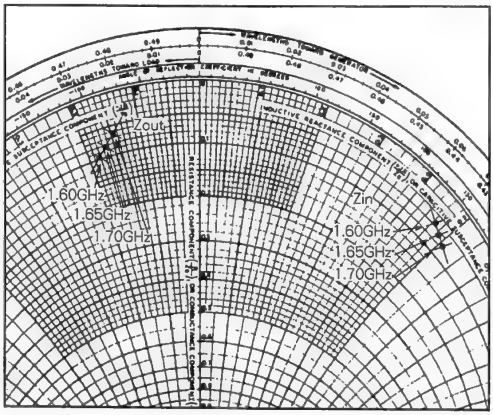
MITSUBISHI ELECTRIC

DC CURRENT AMPLIFICATION RATE VS. COLLECTOR CURRENT



f (GHz)	Żin (Ω)	Żout (Ω)
1.60	2.86 + j23.31	4.39 − j8.99
1.65	3.30 + j24.41	4.13 − j8.24
1.70	3.47 + j25.56	3.09 − j7.19
CONDITIONS : Vcc = 28V, f = 1.6~1.7GHz Po = 6W CW		

Zo = 50 Ω



INPUT AND OUTPUT SERIES IMPEDANCE 2SC4838

ANTENNA SWITCHES

MI105

PIN DIODE

DESCRIPTION

The MI105 PIN diode is employing a high reliability glass construction, designed for small signal switching.

FEATURES

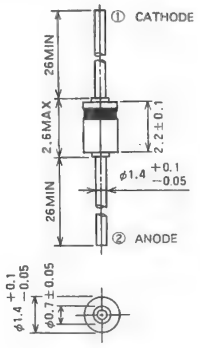
- Long carrier lifetime
- Low diode capacitance (0.25pF @VR=0V, f=100MHz)
- Low forward bias resistance
- Rugged for surge
- Small glass construction

APPLICATION

VCR. Video Disk Antenna switch.

OUTLINE DRAWING

Dimension mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

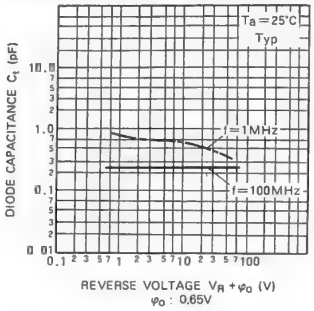
Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	30	V
V_R	Reverse voltage	30	V
P	Power dissipation	200	mW
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55~+175	°C
I_{FM}	Forward current	150	mA

ELECTRICAL CHARACTERISTICS (Ta=25°C)

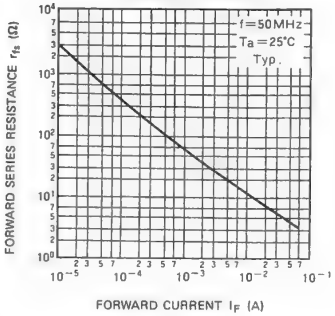
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=30V			10	μA
I_{R2}	Reverse current	V_R=28V			0.5	μA
I_F	Forward current	V_F=1.0V	30	70		mA
C_t	Diode capacitance	V_R=0V, f=100MHz		0.25	0.5	pF
r_{fs1}	Forward series resistance	I_F=10mA, f=50MHz		13	20	Ω
r_{fs2}	Forward series resistance	I_F=10μA, f=50MHz	1.0	3		kΩ

TYPICAL PERFORMANCE DATA

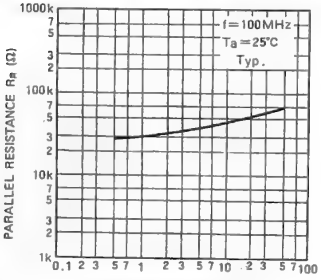
DIODE CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



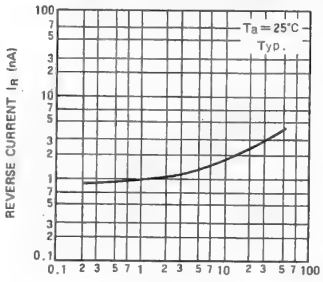
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



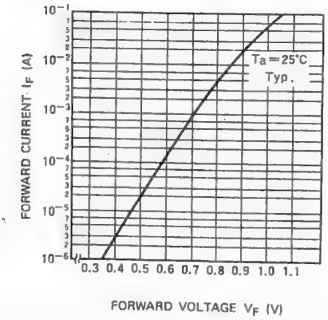
PARALLEL RESISTANCE VS. REVERSE VOLTAGE CHARACTERISTICS



REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



MITSUBISHI ELECTRIC

MI204

PIN DIODE

DESCRIPTION

The MI204 PIN diode is employing a high reliability glass construction designed for RF small signal attenuator in VHF UHF.

FEATURES

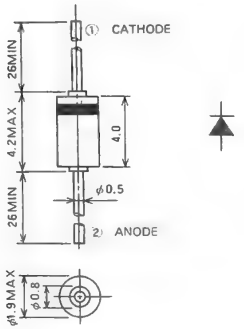
- Long carrier lifetime
- Low distortion
- Large dynamic range

APPLICATION

RF attenuator RF switching

OUTLINE DRAWING

Dimension: mm

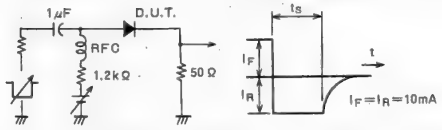


ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	30	V
V_R	Reverse voltage	28	V
P	Power dissipation	200	mW
Tj	Junction temperature	175	°C
Tstg	Storage temperature	−55～+175	°C

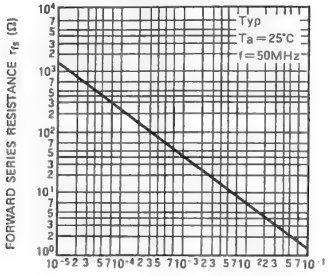
ELECTRICAL CHARACTERISTICS (Ta=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=30V			10	μA
I_{R2}	Reverse current	V_R=28V			0.5	μA
V_F	Forward voltage	I_F=100mA			1.0	V
r_{fs1}	Forward series resistance	I_F=10mA, f=50MHz		5.5	10	Ω
r_{fs2}		I_F=10μA, f=50MHz	1.0	1.5		kΩ
Ct	Diode capacitance	V_R=15V, f=1.0MHz		0.7	1.2	pF
τ	Life time	I_F=10mA		2.1		μs
*ts	Storage time	I_F=10mA, I_R=10mA	0.6	1.5		μs

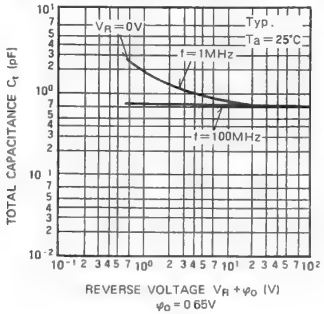
* 

TYPICAL PERFORMANCE DATA

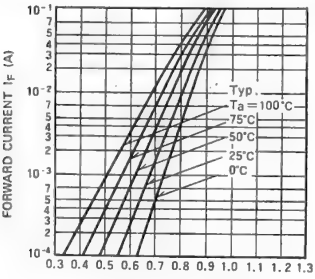
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



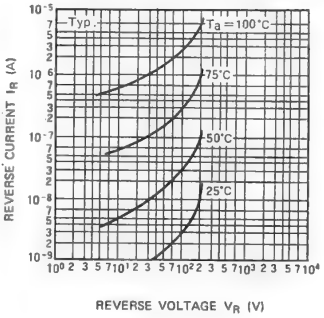
TOTAL CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



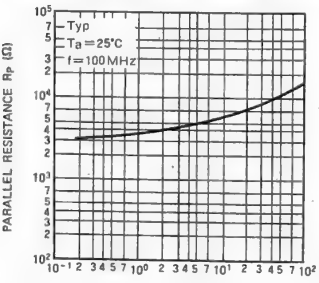
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



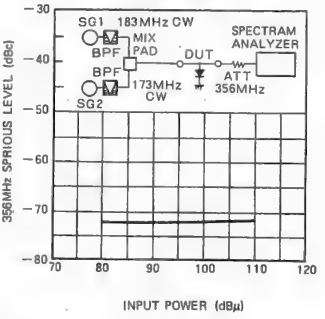
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



PARALLAEL RESISTANCE VS. REVERSE VOLTAGE CHARACTERISTICS



INTER MODULATION DISTORTION



MITSUBISHI ELECTRIC

MI301

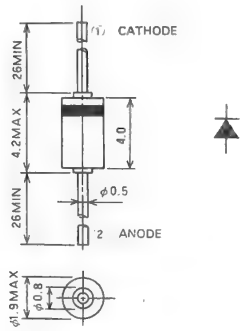
PIN DIODE
RF POWER SWITCHING

DESCRIPTION
The MI301 PIN diode is employing high reliability glass construction, designed for solid state antenna switches in commercial two-way radios.

FEATURES
- Low insertion loss
- High isolation
- Small glass construction

APPLICATION
Antenna switching

OUTLINE DRAWING
Dimension: mm



ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	80	V
I_{FSM} *	Forward surge current	2.0	A
P	Power dissipation	350	mW
T_j	Junction temperature	175	°C
T_{stg}	Storage temperature	−55~+175	°C

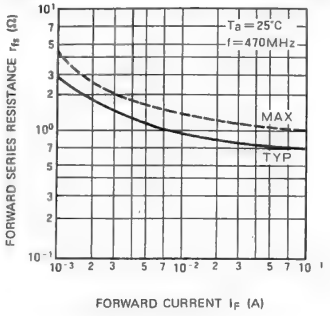
* : t=1sec

ELECTRICAL CHARACTERISTICS (T_a=25°C)

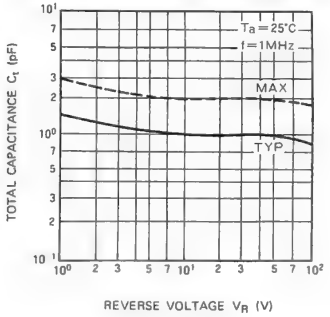
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_R	Reverse current	V_R=60V			150	nA
$V_{(BR)R}$	Reverse break-down voltage	I_R=10μA	80			V
I_F	Forward current	V_F=1.0V	100			mA
Ct	Diode capacitance	V_R=0V, f=1MHz			3.0	pF
r_{fs}	Forward series resistance	I_F=20mA, f=470MHz			1.2	Ω
Q	Q	V_R=0V, f=50MHz	20			—
L_S	Lead inductance	Total lead length 10mm		2.5		nH

TYPICAL PERFORMANCE DATA

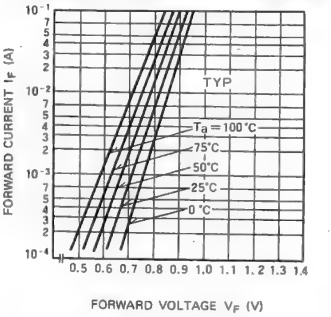
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



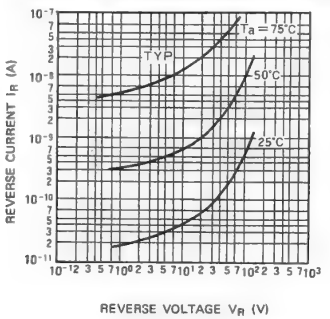
TOTAL CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



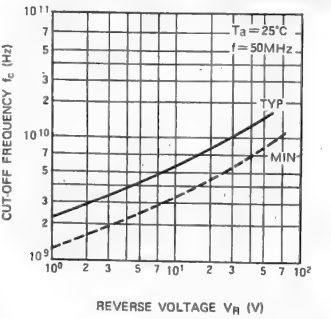
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



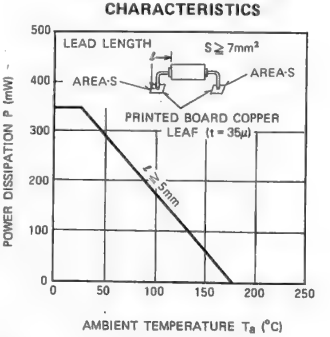
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



CUT-OFF FREQUENCY VS. REVERSE VOLTAGE CHARACTERISTICS

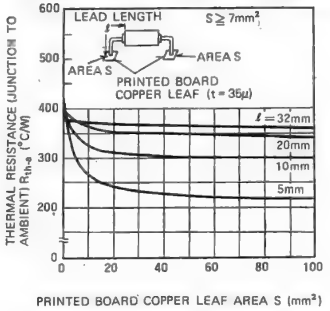


POWER DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS

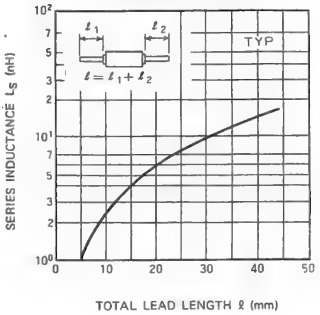


MITSUBISHI ELECTRIC

THERMAL RESISTANCE (JUNCTION TO AMBIENT) VS. PRINTED BOARD COPPER LEAF AREA CHARACTERISTICS

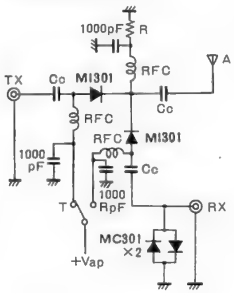


SERIES INDUCTANCE VS. TOTAL LEAD LENGTH CHARACTERISTICS

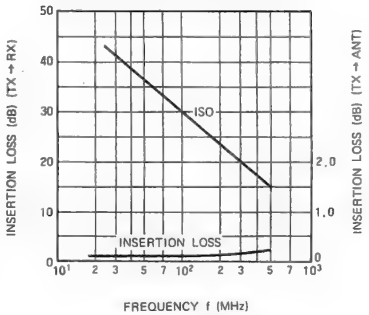


APPLICATION

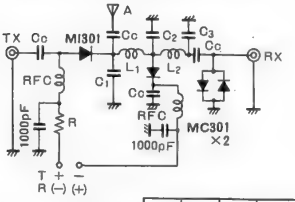
SINGLE POLE DOUBLE THROW SWITCHING CIRCUIT



SINGLE POLE DOUBLE THROW SWITCHING CHARACTERISTICS

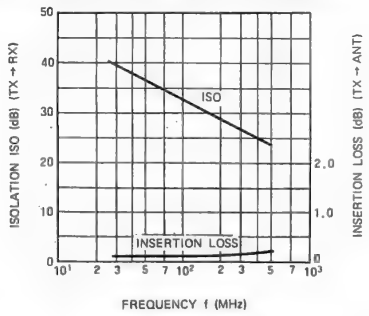


SINGLE POLE DOUBLE THROW SWITCHING CIRCUIT (λ-4 TYPE)



	C1	C2	C3	L1, L2
50MHz	45pF	90pF	35pF	230nH
144MHz	15pF	24pF	6pF	75nH
440MHz	3pF	7pF	2pF	25nH

SINGLE POLE DOUBLE THROW SWITCHING (λ/4 TYPE) CHARACTERISTICS



MI303

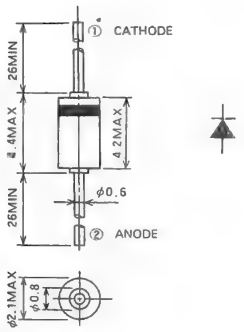
PIN DIODE
RF POWER SWITCHING

DESCRIPTION
The MI303 PIN diode is employing high reliability glass construction, designed for solid state antenna switches in commercial two-way radios.

FEATURES
- Low insertion loss
- High isolation
- Small glass construction

APPLICATION
Antenna switching

OUTLINE DRAWING
Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	180	V
I_{FSM} *	Forward surge current	2	A
P	Power dissipation	500	mW
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55～+175	°C

* : t=5sec

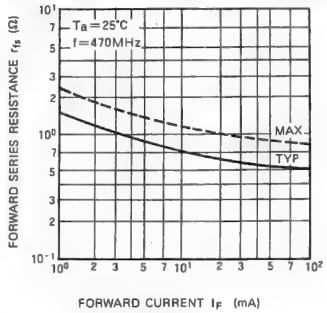
ELECTRICAL CHARACTERISTICS (Ta=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=180V			10	μA
I_{R2}	Reverse current	V_R=140V			150	nA
I_F	Forward current	V_F=1.0V	200			mA
C_t	Diode capacitance	V_R=0V, f=1MHz			4.0	pF
r_{fs}	Forward series resistance	I_F=20mA, f=470MHz			1.0	Ω
f_c	Cut-off frequency	V_R=3V, f=50MHz	800			MHz

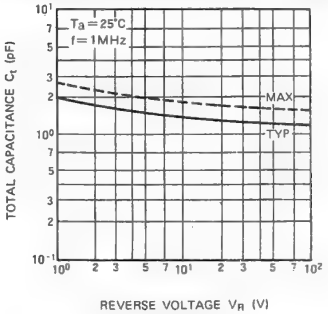
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

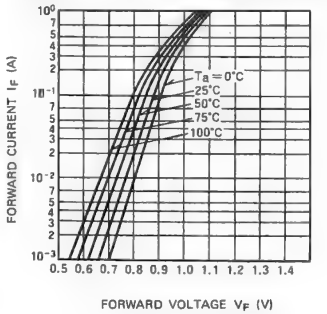
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



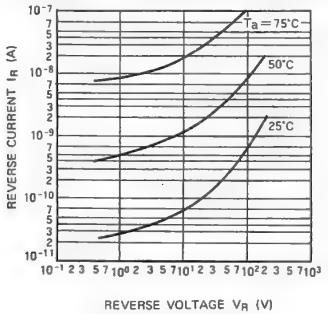
TOTAL CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



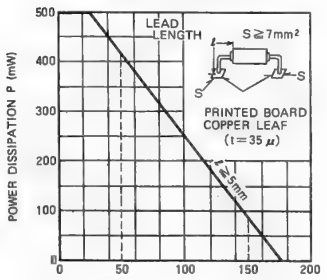
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



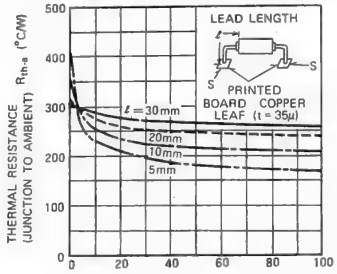
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



POWER DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS

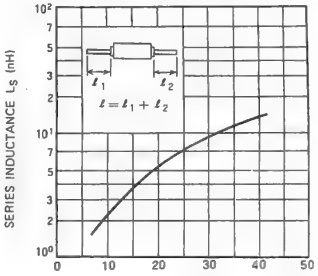


THERMAL RESISTANCE (JUNCTION TO AMBIENT) VS. PRINTED BOARD COPPER LEAF AREA CHARACTERISTICS



PRINTED BOARD COPPER LEAF AREA S (mm²)

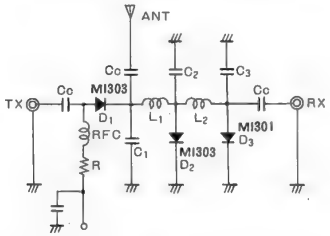
SERIES INDUCTANCE VS. TOTAL LEAD LENGTH CHARACTERISTICS



TOTAL LEAD LENGTH ℓ (mm)

APPLICATION

SINGLE POLE DOUBLE THROW SWITCHING CIRCUIT (λ-4 TYPE)



	C_1	C_2	C_3	L_1, L_2
50MHz	45pF	90pF	35pF	230nH
144MHz	15pF	24pF	10pF	75nH
440MHz	3pF	6pF	2pF	25nH

TYPICAL DATA

f	Isolation TX→RX	Insertion Loss TX→ANT
50MHz	33dB	0.3dB
144MHz	33dB	0.3dB
440MHz	30dB	0.5dB

Handling Power 10W
Bias Current 20mA DC
2nd Harmonic >80dBc

MITSUBISHI ELECTRIC

MI308

PIN DIODE
RF POWER SWITCHING

DESCRIPTION

The MI308 PIN diode is employing a high reliability glass construction, designed for solid state antenna switchs in commercial two-way radios.

FEATURES

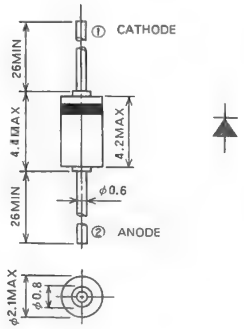
- High power handling
- High zero bias impedance
- Low forward bias resistance
- Low insertion loss, High isolation
- Low distortion (TX: sprious < −80dBc, RX: inter-modulation −73dBc @90dBμ)

APPLICATION

High power antenna switch (10W output two-way radio)

OUTLINE DRAWING

Dimension. mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Rating	Unit
V_{RM}	Repetitive peak reverse voltage	50	V
V_R	Reverse voltage	50	V
I_{FSM} *	Forward surge current	2	A
P	Power dissipation	500	mW
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55～+175	°C

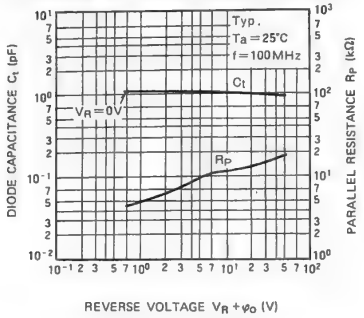
* : t=5sec

ELECTRICAL CHARACTERISTICS (Ta=25°C)

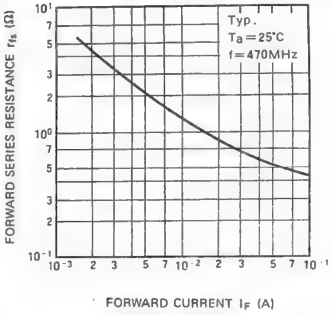
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=50V			10	μA
I_{R2}	Reverse current	V_R=45V			0.5	μA
I_F	Forward current	V_F=1.0V	100			mA
r_{fs}	Forward series resistance	I_F=50mA, f=470MHz		0.5	0.7	Ω
Ct	Diode capacitance	V_R=0V, f=100MHz			1.6	pF
Rp	Parallel resistance	V_R=0V, f=100MHz	1.0	3.0		kΩ

TYPICAL PERFORMANCE DATA

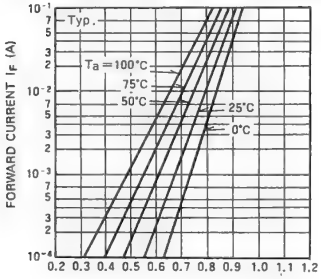
DIODE CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



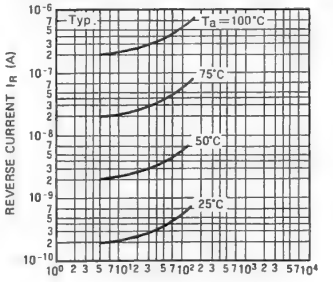
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



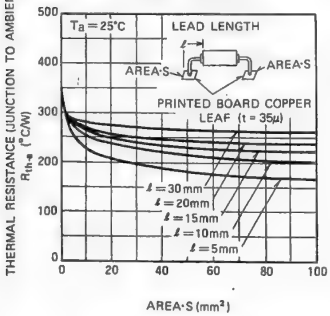
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS

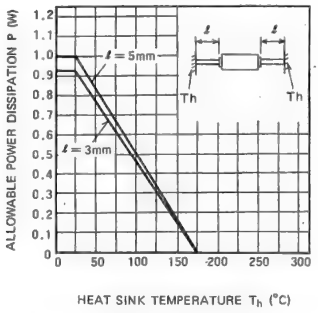


THERMAL RESISTANCE (JUNCTION TO AMBIENT) VS. AREA CHARACTERISTICS

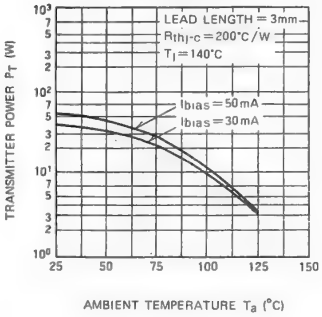


MITSUBISHI ELECTRIC

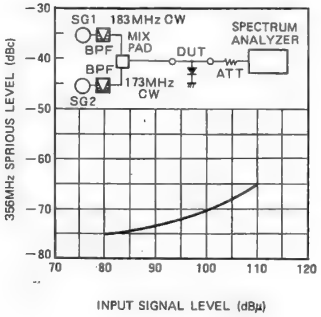
ALLOWABLE POWER DISSIPATION VS. HEAT SINK TEMPERATURE CHARACTERISTICS



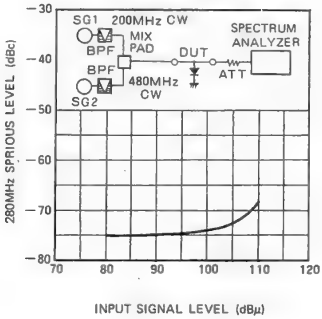
TRANSMITTER POWER VS. AMBIENT TEMPERATURE CHARACTERISTICS



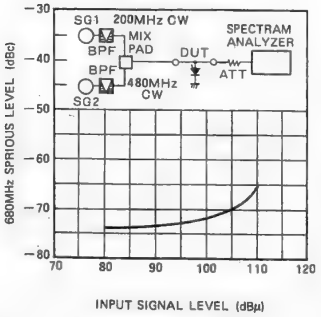
INTER MODULATION DISTORTION



INTER MODULATION DISTORTION



INTER MODULATION DISTORTION



ANTENNA SWITCH

MI402

PIN DIODE
RF POWER SWITCHING

DESCRIPTION

The MI402 PIN diode is employing a high reliability glass construction, designed for solid state antenna switches in commercial two-way radios.

FEATURES

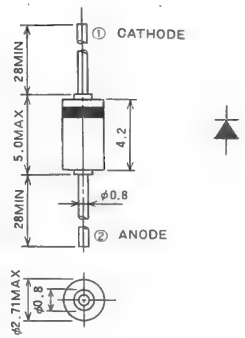
- High power handling
- Low insertion loss, High isolation

APPLICATION

High power antenna switch (25W output two-way radio)

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	270	V
I_{FSM} *	Forward surge current	2.0	A
P	Power dissipation	1.0	mW
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55∼+175	°C

* : t=5sec

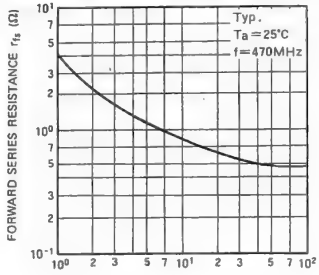
ELECTRICAL CHARACTERISTICS (Ta=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=270V			10.0	μA
I_{R2}	Reverse current	V_R=200V			150	nA
I_F	Forward current	V_F=1.0V	500			mA
Ct	Diode capacitance	V_R=12V, f=1MHz			3.0	pF
r_{fs}	Forward series resistance	I_F=50mA, f=470MHz			0.7	Ω
f_c	Cut-off frequency	V_R=12V, f=50MHz	1.0			GHz

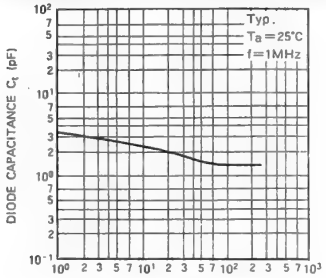
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

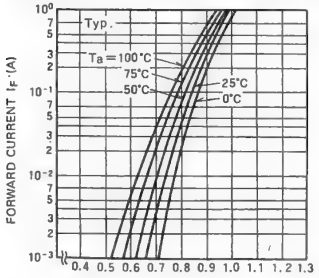
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



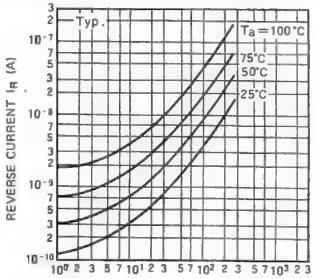
DIODE CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



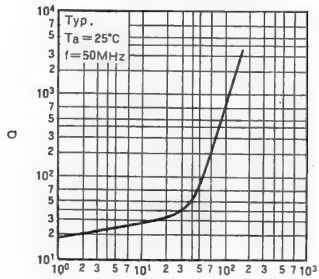
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



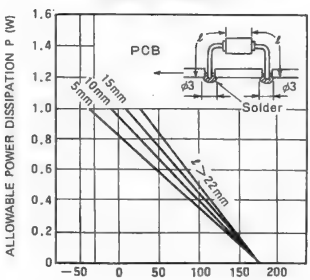
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



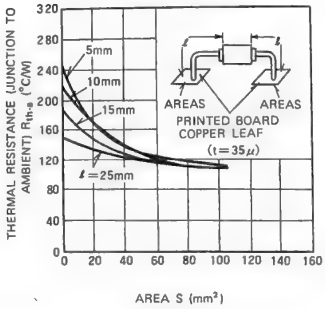
Q VS. REVERSE VOLTAGE CHARACTERISTICS



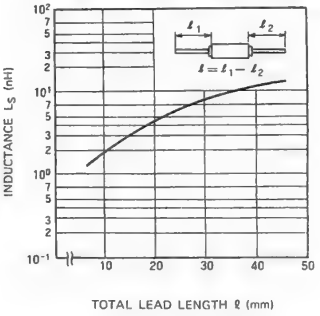
ALLOWABLE POWER DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS



THERMAL RESISTANCE (JUNCTION TO AMBIENT) VS. AREA CHARACTERISTICS

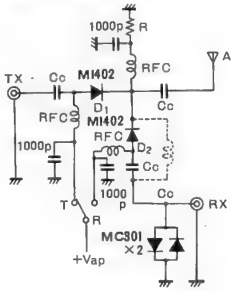


INDUCTANCE VS. TOTAL LEAD LENGTH CHARACTERISTICS



APPLICATION

SINGLE POLE DOUBLE THROW SWITCHING CIRCUIT

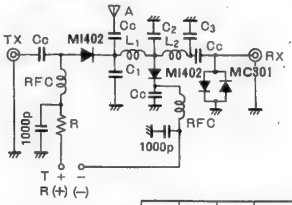


TYPICAL DATA

f	Isolation TX→RX	Insertion Loss TX→A
29MHz	40dB	0.3dB
50MHz	39dB	0.3dB
144MHz	39dB	0.3dB
220MHz	38dB	0.4dB
440MHz	36dB	0.5dB

HANDLING POWER 25W
BIAS CURRENT 50mA DC
SPRIOUS >80dB

SINGLE POLE DOUBLE THROW SWITCHING CIRCUIT (λ-4 TYPE)



	C_1	C_2	C_3	L_1, L_2
50MHz	45pF	90pF	35pF	230nH
144MHz	15pF	22pF	4pF	75nH
220MHz	8pF	15pF	3pF	50nH
440MHz	2pF	5pF	2pF	25nH

TYPICAL DATA

f	Isolation TX→RX	Insertion Loss TX→A
50MHz	27dB	0.3dB
144MHz	33dB	0.3dB
220MHz	31dB	0.4dB
440MHz	24dB	0.5dB

HANDLING POWER 25W
BIAS CURRENT 50mA DC
SPRIOUS >80dB

MITSUBISHI ELECTRIC

MI407

PIN DIODE
RF POWER SWITCHING

DESCRIPTION

The MI407 PIN diode is employing a high reliability glass construction, designed for solid state antenna switches in commercial two-way radios.

FEATURES

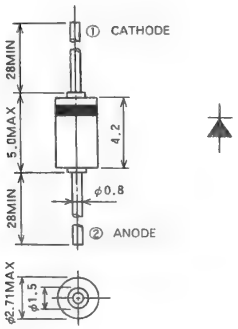
- High power handling
- High zero bias impedance
- Low forward bias resistance
- Low insertion loss, High isolation
- Low distortion (TX: sprious < –80dBc, RX: inter-modulation –73dBc @90dBμ)

APPLICATION

High power antenna switch (25W output two-way radio)

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	50	V
V_R	Reverse voltage	50	V
I_{FSM} *	Forward surge current	2	A
P	Power dissipation	1	W
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55 ~ +175	°C

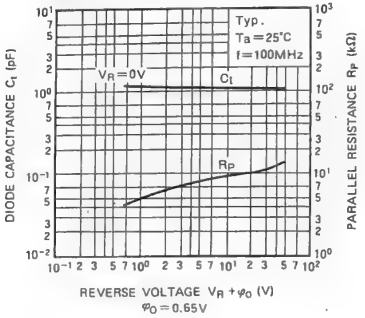
* : t=5sec

ELECTRICAL CHARACTERISTICS (Ta=25°C)

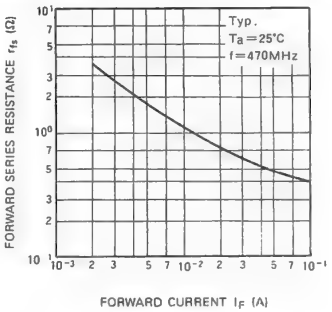
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=50V			10	μA
I_{R2}	Reverse current	V_R=45V			0.5	μA
I_F	Forward current	V_F=1.0V	100			mA
r_{fs}	Forward series resistance	I_F=50mA, f=470MHz		0.5	0.7	Ω
Ct	Diode capacitance	V_R=0V, f=100MHz			1.8	pF
R_P	Parallel resistance	V_R=0V, f=100MHz	1.0	3.0		kΩ

TYPICAL PERFORMANCE DATA

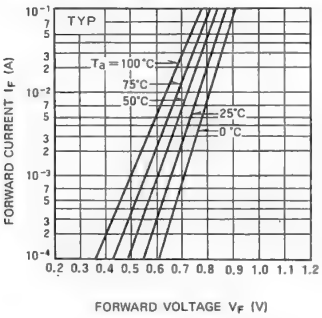
DIODE CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



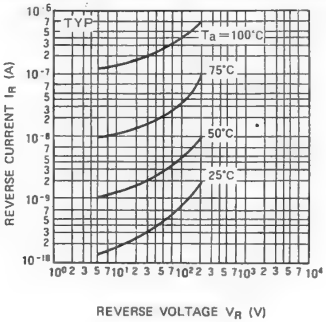
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



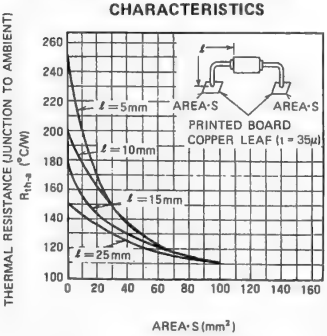
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



THERMAL RESISTANCE (JUNCTION TO AMBIENT) VS. AREA CHARACTERISTICS



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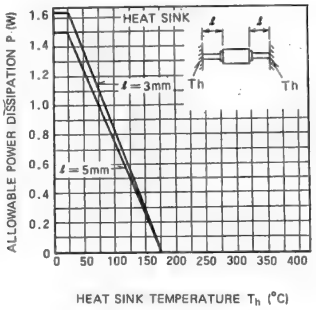
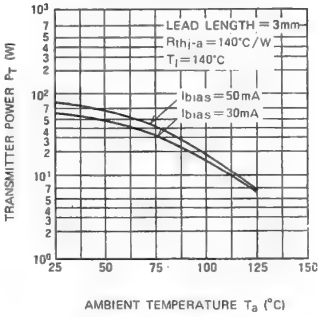
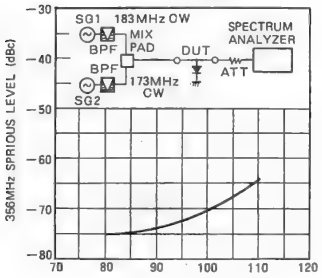
ALLOWABLE POWER DISSIPATION VS. HEAT SINK TEMPERATURE CHARACTERISTICS



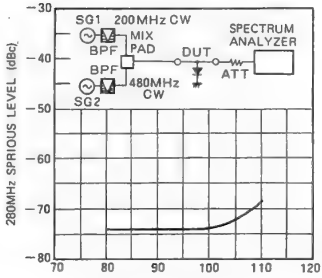
TRANSMITTER POWER VS. AMBIENT TEMPERATURE CHARACTERISTICS



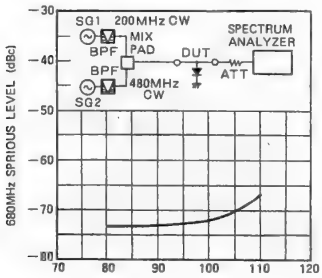
INTER MODULATION DISTORTION



INTER MODULATION DISTORTION



INTER MODULATION DISTORTION



MI809

PIN DIODE
RF POWER SWITCHING

DESCRIPTION

The MI809 PIN diode is designed for solid state antenna switching applications in mobile radios. The construction of MI809 is employing a SQUARE OUTLINE which is suitable for reflow assembly on surface mounting.

FEATURES

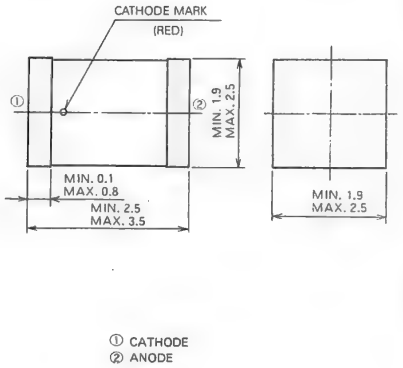
- High power handling
- High zero bias resistance
- Low forward bias resistance
- Low insertion loss, High isolation
- Low distortion
- Surface mounting type (for reflow assembly)

APPLICATION

High power antenna switch (10W output two-way radio)

OUTLINE DRAWING

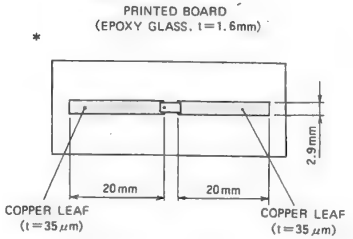
Dimension : mm



① CATHODE
② ANODE

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Symbol	Parameter	Ratings	Unit
V_R	Reverse voltage	50	V
P *	Power dissipation (contact surface)	1 @ 25°C	W
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55 ~ +175	°C



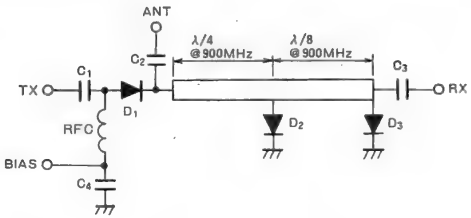
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_R	Reverse current	V_R=50V			10	μA
V_F	Forward voltage	I_F=50mA			1.0	V
r_{fs}	Forward series resistance	I_F=50mA, f=100MHz		0.5	0.75	Ω
Ct	Diode capacitance	V_R=40V, f=1MHz			1.2	pF
R_P	Parallel resistance	V_R=0V, f=100MHz	1.0	3.0		kΩ

MITSUBISHI ELECTRIC

APPLICATION

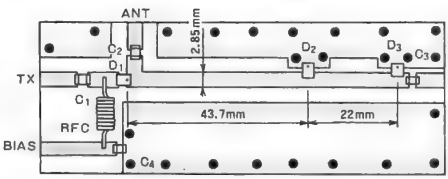
◎ 800MHz BAND ANTENNA SWITCH (800MHz ~ 940MHz, HANDLING POWER 15W)



CIRCUIT DIAGRAM

PARTS LIST

• C_1, C_2, C_3, C_4	1000pF CHIP CAPACITOR
• D_1, D_2, D_3	MI809
• RFC	9 TURN φ4 1.6 DIA. ENAMEL WIRE
• SUBSTRATE	EPOXY GLASS $\epsilon = 4.7$, t = 1.6mm BOTH SIDES COPPER (t = 35μm)

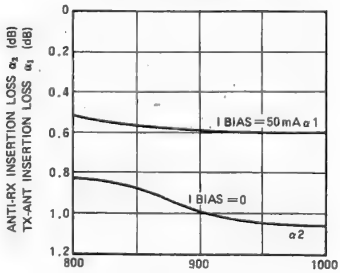


SUBSTRATE DRAWING

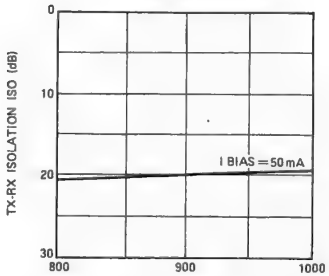
EACH ● POINTS SHOULD BE TREATED CONNECTIONS BETWEEN BOTH SIDES GROUNDS ON THROUGH HOLE.

CHARACTERISTICS

**TX-ANT INSERTION LOSS
ANT-RX INSERTION LOSS**

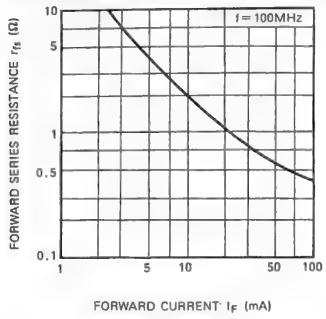


**TX-RX ISOLATION
CHARACTERISTICS**

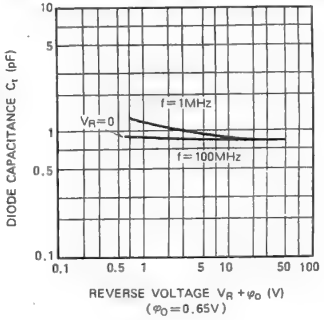


TYPICAL PERFORMANCE DATA

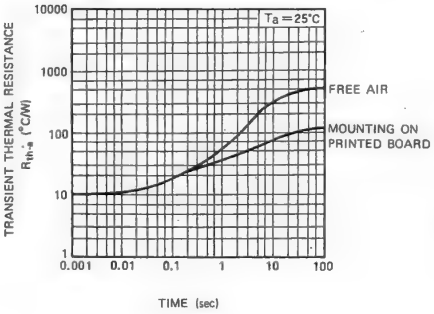
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS

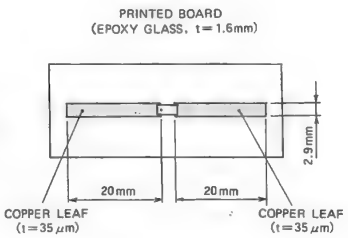


DIODE CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



TRANSIENT THERMAL RESISTANCE VS. TIME CHARACTERISTICS





MITSUBISHI ELECTRIC

HYBRID ANTENNA SWITCHES

MD001

400~512MHz, 5W, ANTENNA SWITCH

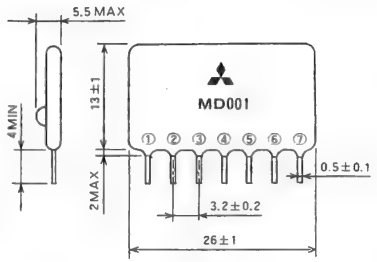
MINIATURE RF ANTENNA SWITCH

MD001 is designed to cover 400 ~ 512MHz, 5W, antenna switch module.

- Small, Easily Mounted Package.
- High Isolation: 40dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output: 2nd Harmonic < −70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

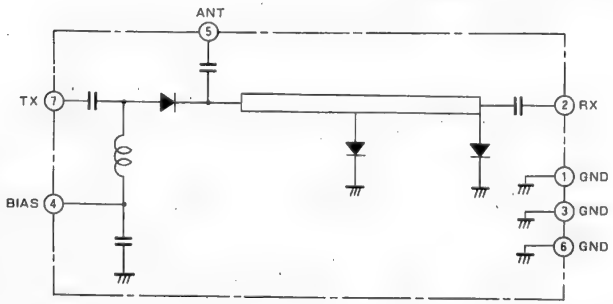
OUTLINE DRAWING

Dimensions in mm



(1) GND
(2) RX
(3) GND
(4) BIAS
(5) ANT
(6) GND
(7) TX

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
I_{bias} = 50mA	ON	OFF
I_{bias} = 0	OFF	ON

400~512MHz, 5W, ANTENNA SWITCH

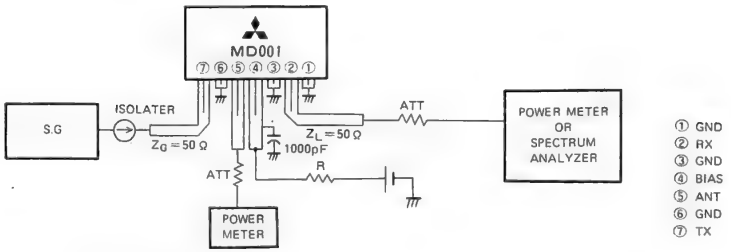
ABSOLUTE MAXIMUM RATINGS (T_a=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
I_{bias}	Bias current	100	mA
P_{in}	Input power	12 @ $T_a \leq 60$°C	W
T_{stg}	Storage temperature	−30 ~ +85	°C

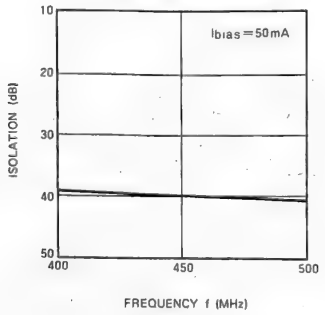
ELECTRICAL CHARACTERISTICS (T_a=25°C)

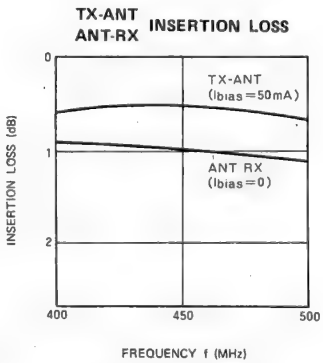
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		400		512	MHz
ISO	Isolation (TX-RX)	P_{in} = 8 W, I_{bias} = 50mA, ANT port terminated 50 Ω	30	40		dB
α_1	Insertion loss (TX-ANT)	P_{in} = 8 W, I_{bias} = 50mA, RX port terminated 50 Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	P_{in} = 1mW, I_{bias} = 0, TX port terminated 50 Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO, α_1)



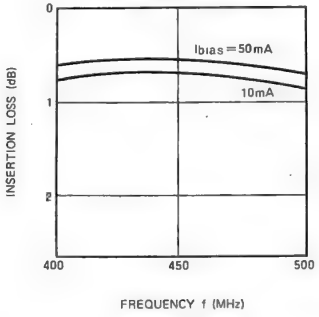
TYPICAL PERFORMANCE DATA



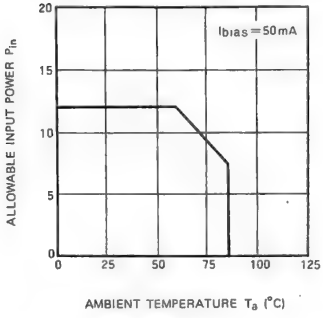


400~512MHz, 5W, ANTENNA SWITCH

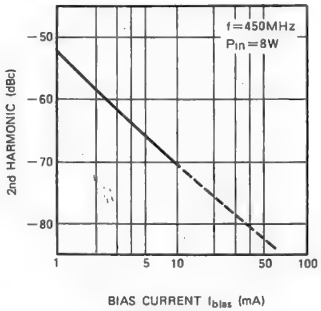
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD001.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ①, ③, ⑥ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

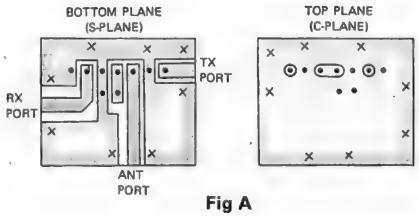


Fig A

MD001A

400~512MHz, 10W, ANTENNA SWITCH

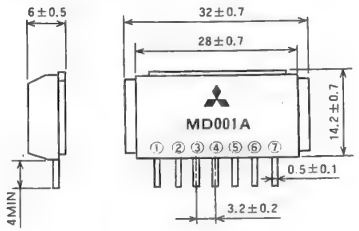
MINIATURE RF ANTENNA SWITCH

MD001A is designed to cover 400 ~ 512MHz, 10W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 40dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output: 2nd Harmonic < −70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

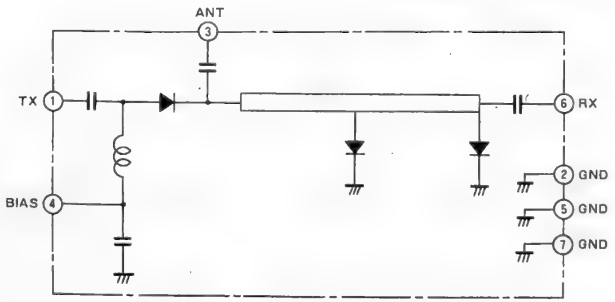
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

MITSUBISHI ELECTRIC

400~512MHz, 10W, ANTENNA SWITCH

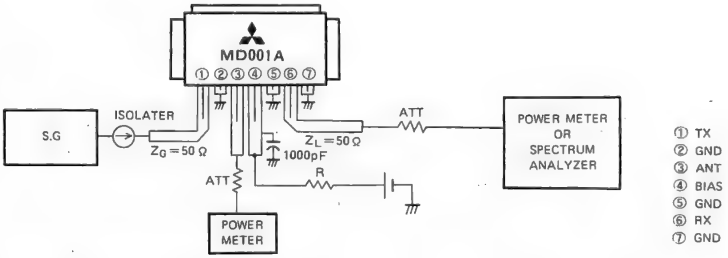
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	17 Ta≦60°C	W
Tstg	Storage temperature	−30~+85	°C

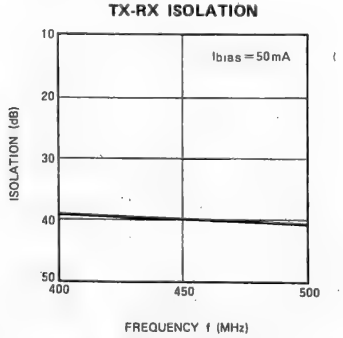
ELECTRICAL CHARACTERISTICS (Ta=25°C)

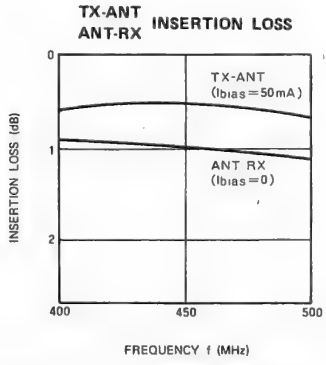
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		400		512	MHz
ISO	Isolation (TX-RX)	Pin=15W, Ibias=50mA, ANT port terminated 50Ω	30	40		dB
α_1	Insertion loss (TX-ANT)	Pin=15W, Ibias=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO, α_1)

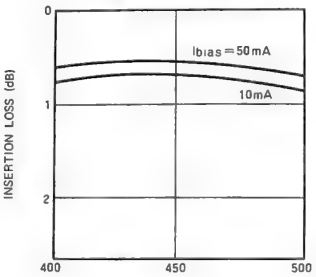


TYPICAL PERFORMANCE DATA

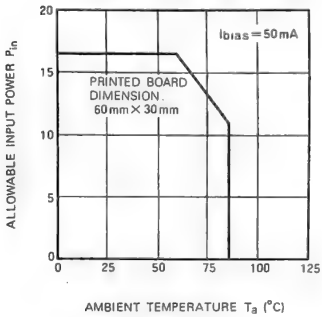




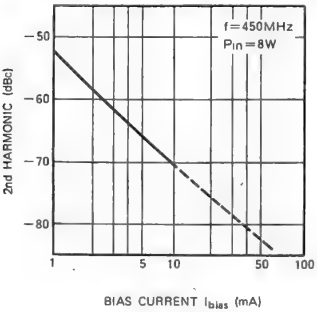
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD001A.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ②, ⑤, ⑦ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

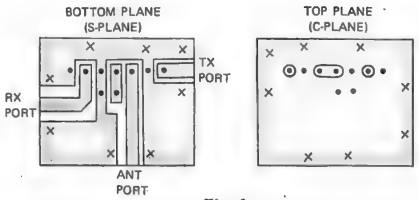


Fig A

MITSUBISHI ELECTRIC

MD001AL

330~400MHz, 10W, ANTENNA SWITCH

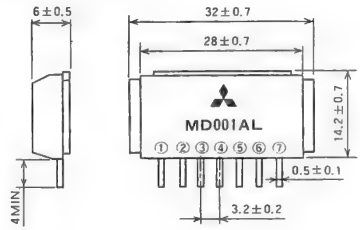
MINIATURE RF ANTENNA SWITCH

MD001AL is designed to cover 330 ~ 400MHz, 10W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 38dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 0.8dB Typ.
- Low Harmonic Output: 2nd Harmonic < −70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

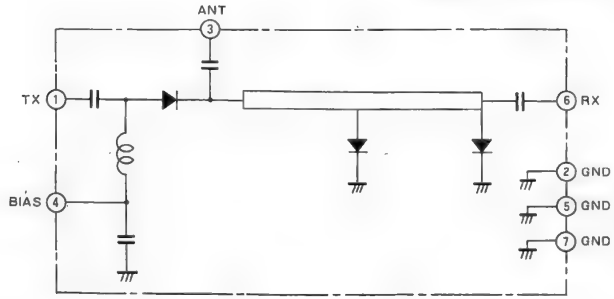
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

330~400MHz, 10W, ANTENNA SWITCH

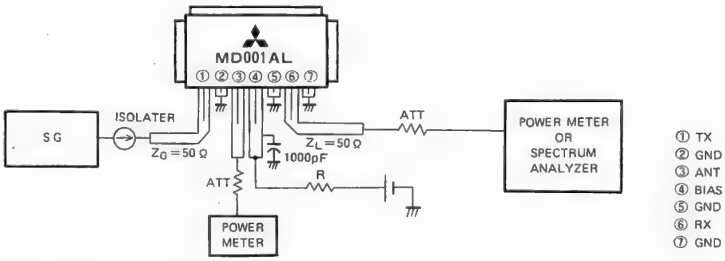
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
P_{in}	Input power	17 Ta≦60°C	W
Tstg	Storage temperature	−30~+85	°C

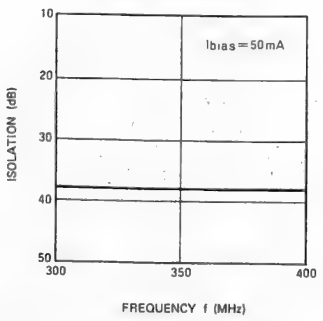
ELECTRICAL CHARACTERISTICS (Ta=25°C)

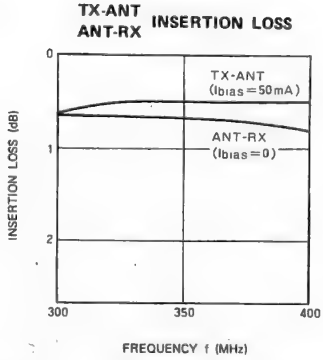
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		330		400	MHz
ISO	Isolation (TX-RX)	P_{in}=15W, Ibias=50mA, ANT port terminated 50Ω	30	38		dB
α_1	Insertion loss (TX-ANT)	P_{in}=15W, Ibias=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	P_{in}=1mW, Ibias=0, TX port terminated 50Ω		0.8	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)



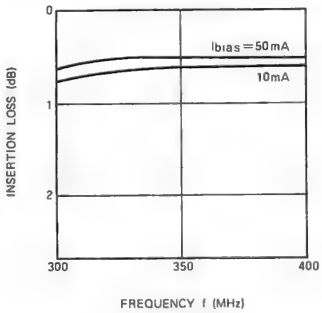
TYPICAL PERFORMANCE DATA



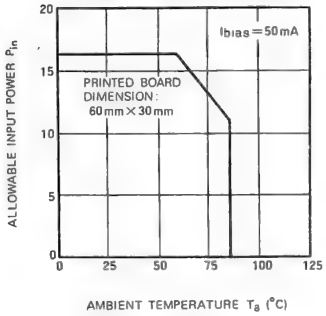


MITSUBISHI ELECTRIC

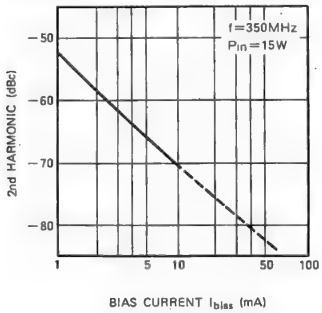
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD001AL.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ②, ⑤, ⑦ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

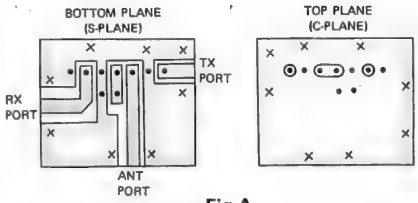


Fig A

MD001H

400~512MHz, 25W, ANTENNA SWITCH

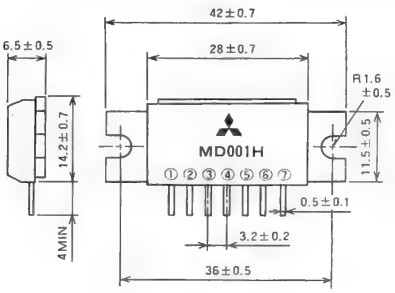
MINIATURE RF ANTENNA SWITCH

MD001H is designed to cover 400 ~ 512MHz, 25W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 40dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output: 2nd Harmonic < −70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

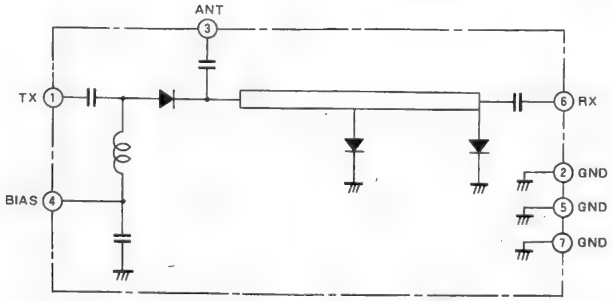
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

MITSUBISHI ELECTRIC

400～512MHz, 25W, ANTENNA SWITCH

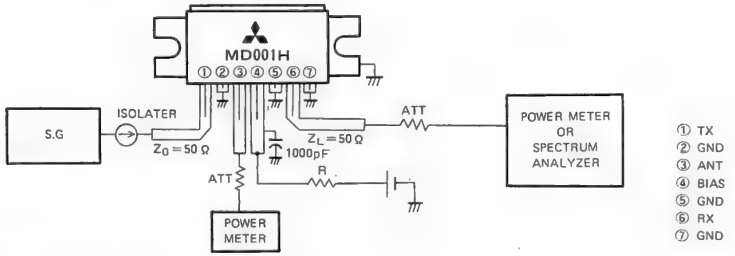
ABSOLUTE MAXIMUM RATINGS (T_a=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
I_{bias}	Bias current	100	mA
P_{in}	Input power	50 $T_O \leq 90°C$	W
T_{stg}	Storage temperature	−30～+110	°C

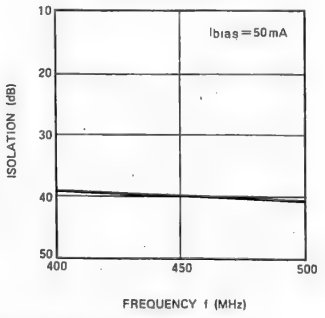
ELECTRICAL CHARACTERISTICS (T_a=25°C)

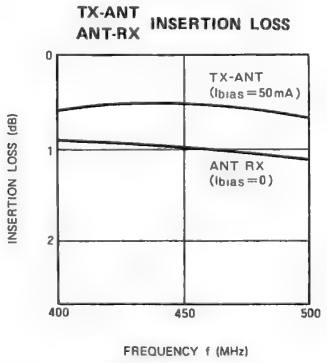
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		400		512	MHz
ISO	Isolation (TX-RX)	P_{in}=40W, I_{bias}=50mA, ANT port terminated 50Ω	30	40		dB
α_1	Insertion loss (TX-ANT)	P_{in}=40W, I_{bias}=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	P_{in}=1mW, I_{bias}=0, TX port terminated 50Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO, α_1)

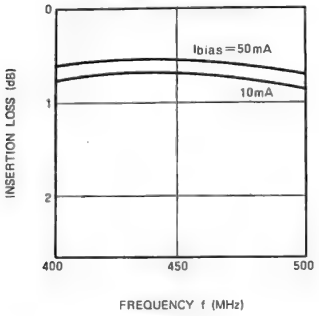


TYPICAL PERFORMANCE DATA

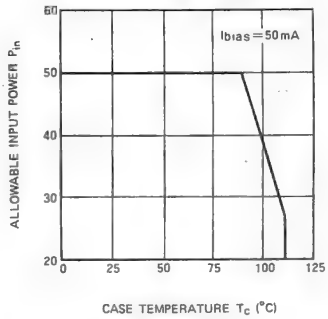




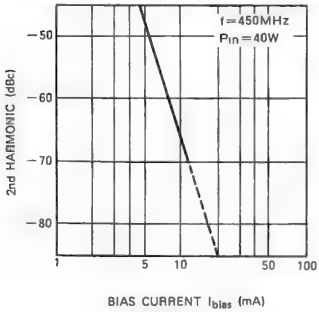
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated diodes at standard operation

(1) Thermal resistance between junction and package of incorporated diodes.
$R_{th(j-c)}$ = 70°C/W (Typ.)

(2) Junction temperature of incorporated diodes at standard operation. Conditions for standard operation.
P_{in} = 33W, I_{bias} = 50mA (VF = 0.85V)(1), r_{fs} = 0.7Ω(2), Z_O = 50Ω(3)

Note 1: Forward Voltage of diodes.
Note 2: Series Resistance of diodes.
Note 3: Characteristic Impedance.

- Junction temperature of diodes

$T_j = [(P_{in}/Z_o) \times r_{fs} + I_{bias} \times VF] \times R_{th(j-c)} + T_c$(4)
$= [(33/50) \times 0.7 + 0.05 \times 0.85] \times 70 + T_c$
$= 35.3 + T_c$ (°C)

Note 4: Package temperature of device

2. Heat sink design

In thermal design of heat sink, try to keep the package tempeatrure at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the input power of 33W below 90°C.

The thermal resistance $R_{th(c-a)}$(5) of the heat sink to realize this:

$R_{th(c-a)} = (T_C - T_a)/(P_{in} - P_{out}) = (90-60)/(33-29.4)$(6)
$= 8.3$ (°C/W)

Note 5: Inclusive of the contact thermal resistance between device and heat sink.
Note 6: Insertion loss is 0.5dB

Mounting the heat sink of the above thermal resistance on the device,
T_j = 125.3°C, T_c = 90°C
In the annual average of ambient temperature is 30°C,
T_j = 95.3°C
As the maximum junction temperature of these incorporated diodes T_{jmax} are 175°C, application under fully derated condition is ensured.

MD001HL

330~400MHz, 25W, ANTENNA SWITCH

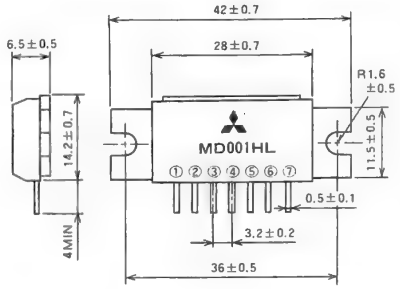
MINIATURE RF ANTENNA SWITCH

MD001HL is designed to cover 330 ~ 400MHz, 25W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 38dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 0.8dB Typ.
- Low Harmonic Output: 2nd Harmonic < −70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

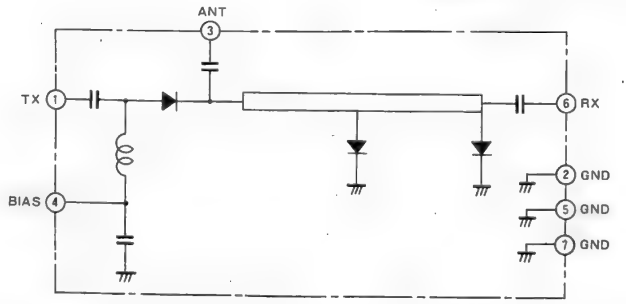
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
I_{bias} = 50mA	ON	OFF
I_{bias} = 0	OFF	ON

MITSUBISHI ELECTRIC

330~400MHz, 25W, ANTENNA SWITCH

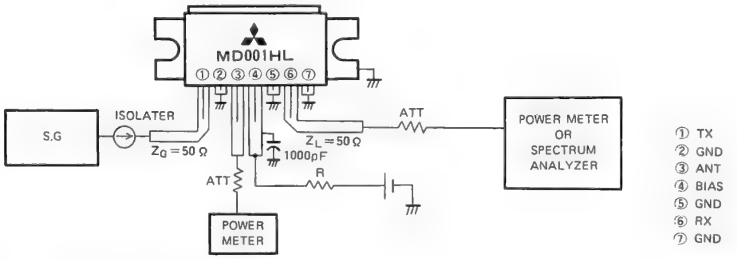
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	50 To≦90°C	W
Tstg	Storage temperature	−30~+110	°C

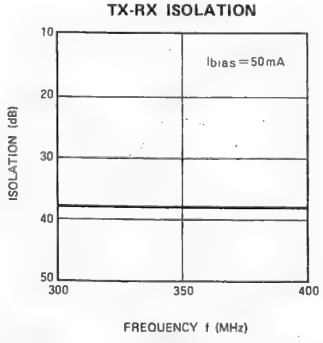
ELECTRICAL CHARACTERISTICS (Ta=25°C)

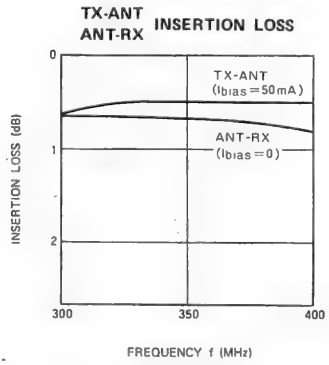
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		330		400	MHz
ISO	Isolation (TX-RX)	Pin=40W, Ibias=50mA, ANT port terminated 50Ω	30	38		dB
α_1	Insertion loss (TX-ANT)	Pin=40W, Ibias=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50Ω		0.8	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

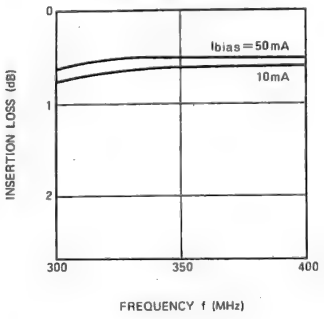


TYPICAL PERFORMANCE DATA

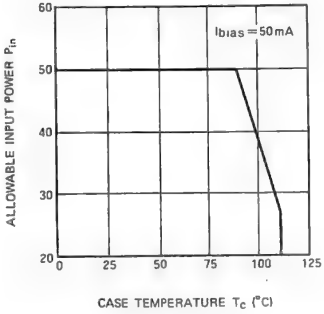




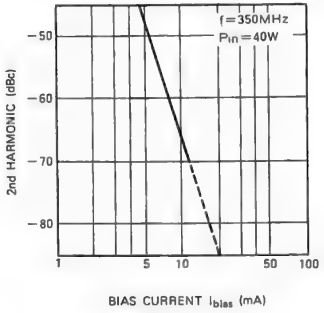
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated diodes at standard operation

(1) Thermal resistance between junction and package of incorporated diodes.
$R_{th(j-c)}$ = 70°C/W (Typ.)

(2) Junction temperature of incorporated diodes at standard operation. Conditions for standard operation.
P_{in} = 33W, I_{bias} = 50mA (VF = 0.85V)(1), r_{fs} = 0.7Ω(2), Z_o = 50Ω(3)

Note 1: Forward Voltage of diodes.
Note 2: Series Resistance of diodes.
Note 3: Characteristic Impedance.

- Junction temperature of diodes

$$T_j = [(P_{in}/Z_o) \times r_{fs} + I_{bias} \times VF] \times R_{th(j-c)} + T_c \text{(4)}$$
$$= [(33/50) \times 0.7 + 0.05 \times 0.85] \times 70 + T_c$$
$$= 35.3 + T_c \ (°C)$$

Note 4: Package temperature of device

2. Heat sink design

In thermal design of heat sink, try to keep the package tempeatrure at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the input power of 33W below 90°C.

The thermal resistance $R_{th(c-a)}$(5) of the heat sink to realize this:

$$R_{th(c-a)} = (T_c - T_a)/(P_{in} - P_{out}) = (90-60)/(33-29.4) \text{(6)}$$
$$= 8.3 \ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink.
Note 6: Insertion loss is 0.5dB

Mounting the heat sink of the above thermal resistance on the device,
T_j = 125.3°C, T_c = 90°C
In the annual average of ambient temperature is 30°C,
T_j = 95.3°C
As the maximum junction temperature of these incorporated diodes T_{jmax} are 175°C, application under fully derated condition is ensured.

MD001L

330~400MHz, 5W, ANTENNA SWITCH

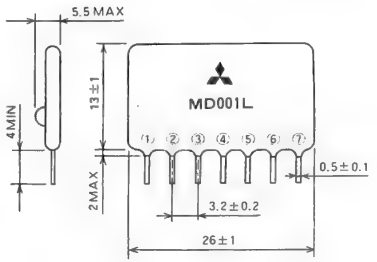
MINIATURE RF ANTENNA SWITCH

MD001L is designed to cover 330 ~ 400MHz, 5W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 38dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 0.8dB Typ.
- Low Harmonic Output: 2nd Harmonic < −70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

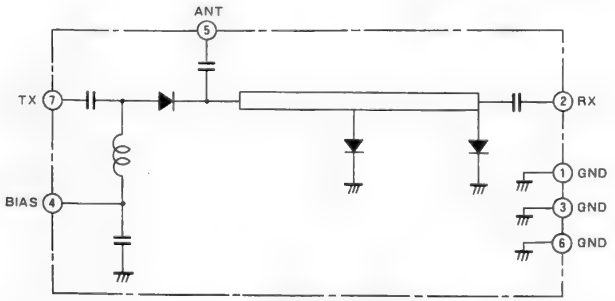
OUTLINE DRAWING

Dimensions in mm



① GND
② RX
③ GND
④ BIAS
⑤ ANT
⑥ GND
⑦ TX

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
I_{bias} = 50mA	ON	OFF
I_{bias} = 0	OFF	ON

MITSUBISHI ELECTRIC

330~400MHz, 5W, ANTENNA SWITCH

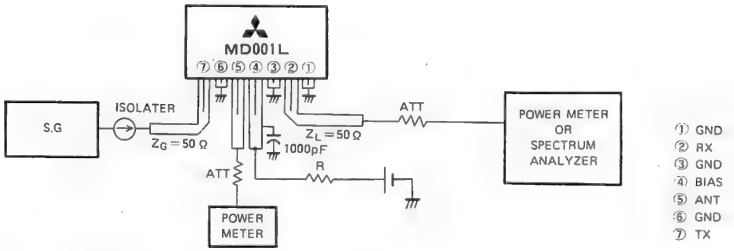
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	12 @ Ta≦60°C	W
Tstg	Storage temperature	−30 ~ +85	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

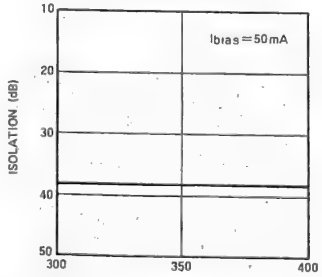
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		330		400	MHz
ISO	Isolation (TX-RX)	Pin=8 W, Ibias=50mA, ANT port terminated 50 Ω	30	38		dB
α_1	Insertion loss (TX-ANT)	Pin=8 W, Ibias=50mA, RX port terminated 50 Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50 Ω		0.8	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO, α_1)

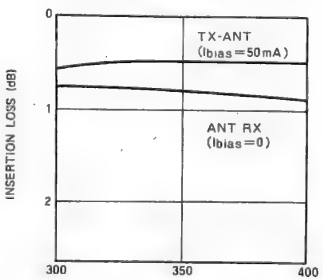


TYPICAL PERFORMANCE DATA

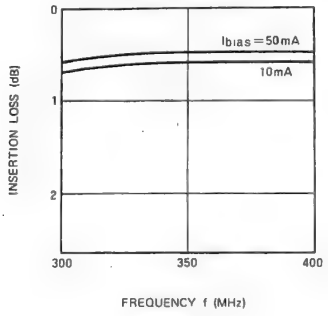
TX-RX ISOLATION



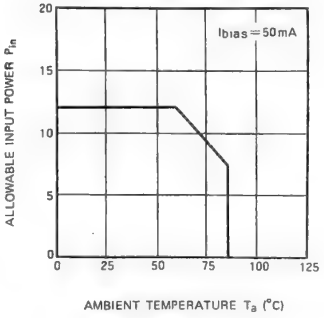
TX-ANT
ANT-RX INSERTION LOSS



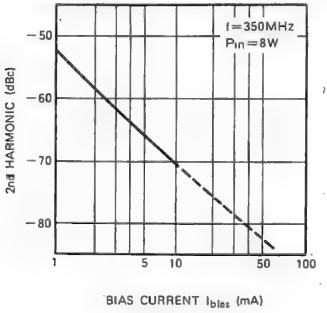
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD001L.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ①, ③, ⑤ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

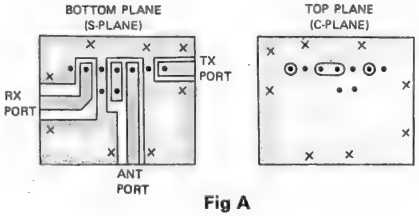


Fig A

MITSUBISHI ELECTRIC

MD003

800~940MHz, 5W, ANTENNA SWITCH

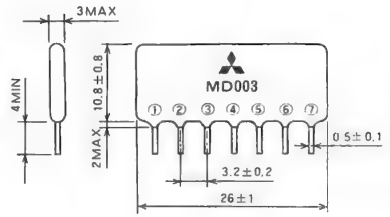
MINIATURE RF ANTENNA SWITCH

MD003 is designed to cover 800 ~ 940MHz, 5W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 35dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output: 2nd Harmonic < −70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

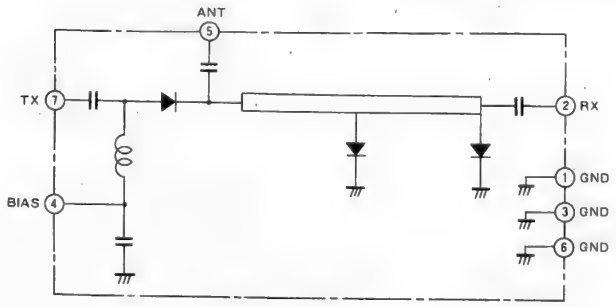
OUTLINE DRAWING

Dimensions in mm



① GND
② RX
③ GND
④ BIAS
⑤ ANT
⑥ GND
⑦ TX

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
I_{bias} = 50mA	ON	OFF
I_{bias} = 0	OFF	ON

800～940MHz, 5W, ANTENNA SWITCH

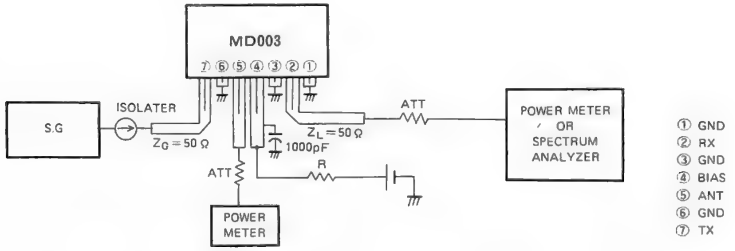
ABSOLUTE MAXIMUM RATINGS (T_a=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
I_{bias}	Bias current	100	mA
P_{in}	Input power	12 @ $T_a \leq 60$°C	W
T_{stg}	Storage temperature	−30 − +85	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

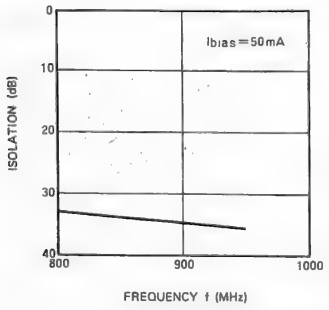
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		800		940	MHz
ISO	Isolation (TX-RX)	P_{in}= 8 W, I_{bias}=50mA, ANT port terminated 50 Ω	30	35		dB
α_1	Insertion loss (TX-ANT)	P_{in}= 8 W, I_{bias}=50mA, RX port terminated 50 Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	P_{in}=1mW, I_{bias}=0, TX port terminated 50 Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO, α_1)

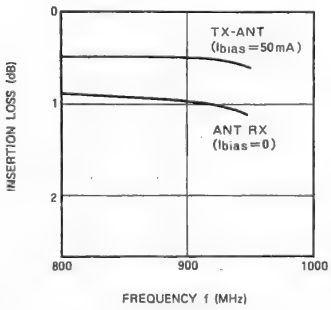


TYPICAL PERFORMANCE DATA

TX-RX ISOLATION



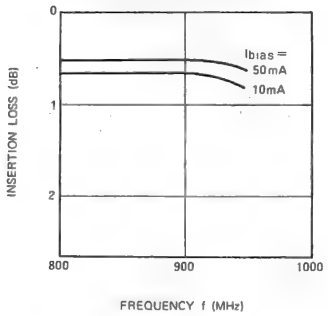
TX-ANT
ANT-RX INSERTION LOSS



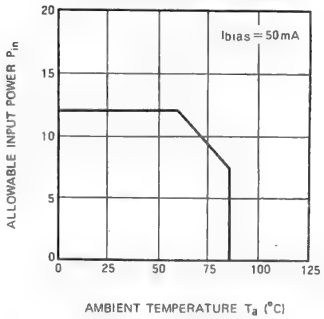
MITSUBISHI ELECTRIC

800~940MHz, 5W, ANTENNA SWITCH

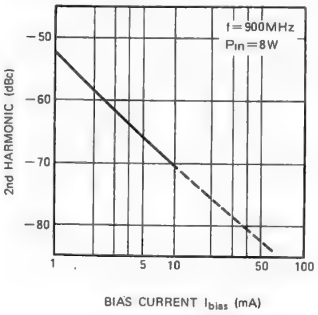
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD003.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ①, ③, ⑥ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

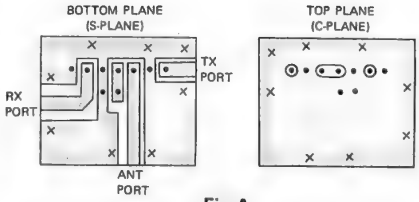


Fig A

MD003A

800~940MHz, 10W, ANTENNA SWITCH

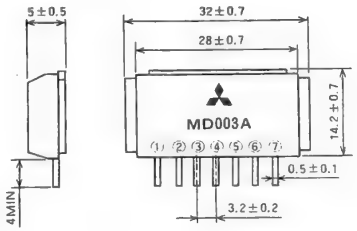
MINIATURE RF ANTENNA SWITCH

MD003A is designed to cover 800 ~ 940MHz, 10W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 35dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output: 2nd Harmonic < −70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

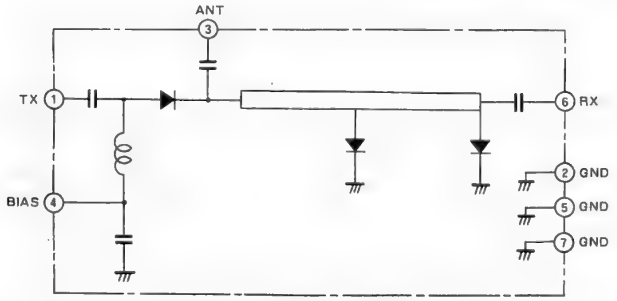
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

MITSUBISHI ELECTRIC

800~940MHz, 10W, ANTENNA SWITCH

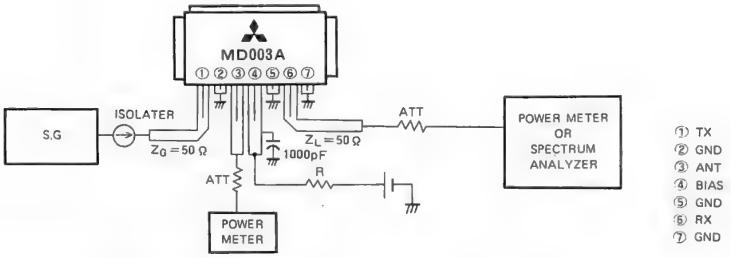
ABSOLUTE MAXIMUM RATINGS (T_a=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
I_{bias}	Bias current	100	mA
P_{in}	Input power	17 $T_a \leq 60°C$	W
T_{stg}	Storage temperature	−30 ~ +85	°C

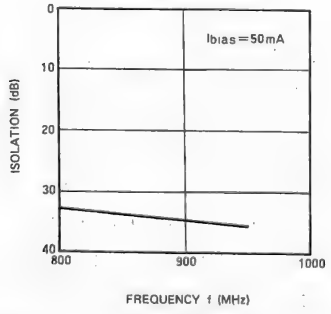
ELECTRICAL CHARACTERISTICS (T_a=25°C)

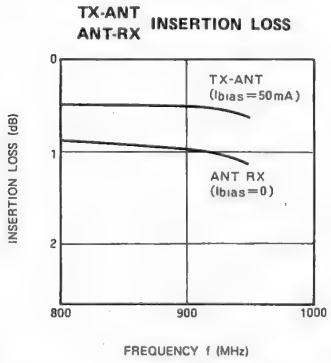
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		800		940	MHz
ISO	Isolation (TX-RX)	P_{in}=15W, I_{bias}=50mA, ANT port terminated 50Ω	30	35		dB
α_1	Insertion loss (TX-ANT)	P_{in}=15W, I_{bias}=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	P_{in}=1mW, I_{bias}=0, TX port terminated 50Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO, α_1)

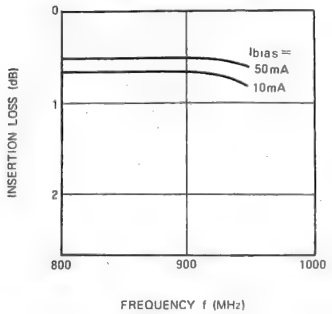


TYPICAL PERFORMANCE DATA

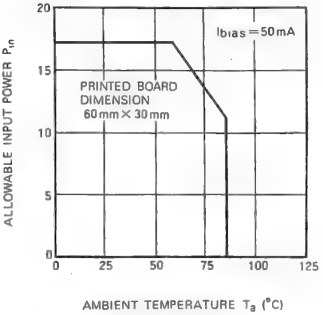




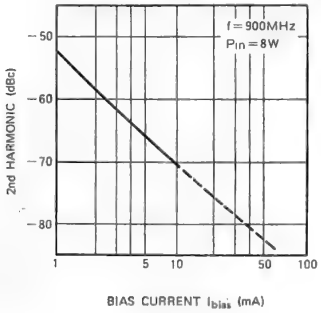
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD003A.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ②, ⑤, ⑦ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

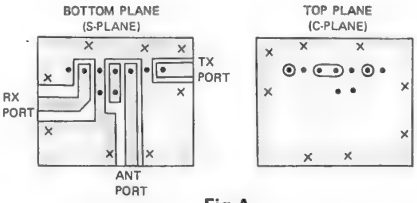


Fig A

MITSUBISHI ELECTRIC

MD003H

800~940MHz, 25W, ANTENNA SWITCH

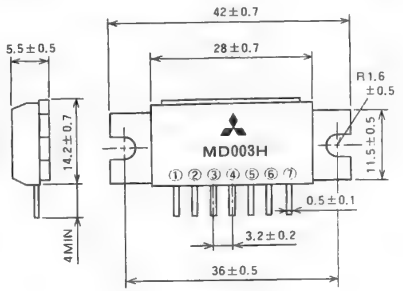
MINIATURE RF ANTENNA SWITCH

MD003H is designed to cover 800 ~ 940MHz, 25W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 35dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output:
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

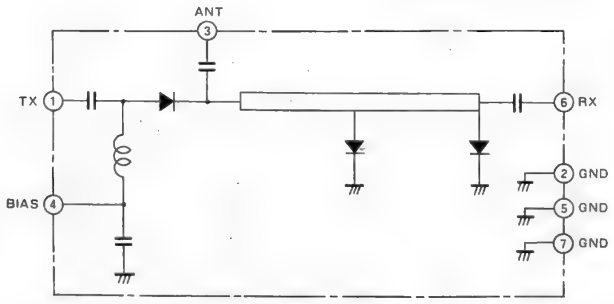
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias = 50mA	ON	OFF
Ibias = 0	OFF	ON

800~940MHz, 25W, ANTENNA SWITCH

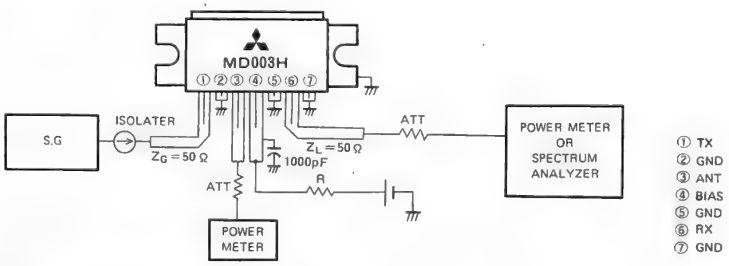
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
P_{in}	Input power	50 $T_C \leqq 90°C$	W
Tstg	Storage temperature	−30~+110	°C

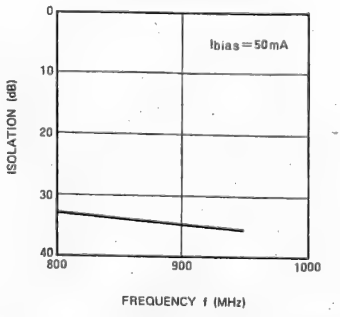
ELECTRICAL CHARACTERISTICS (Ta=25°C)

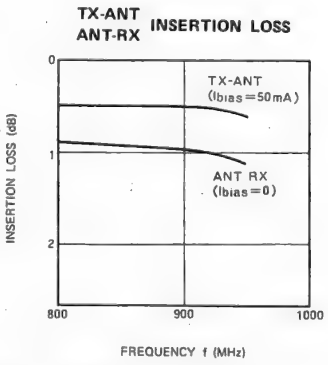
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		800		940	MHz
ISO	Isolation (TX-RX)	P_{in}=30W, Ibias=50mA, ANT port terminated 50Ω	30	35		dB
α_1	Insertion loss (TX-ANT)	P_{in}=30W, Ibias=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	P_{in}=1mW, Ibias=0, TX port terminated 50Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

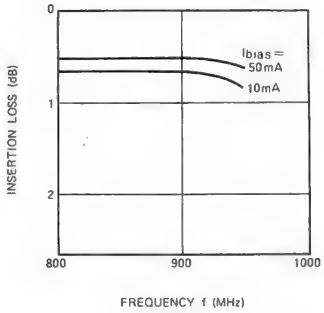


TYPICAL PERFORMANCE DATA

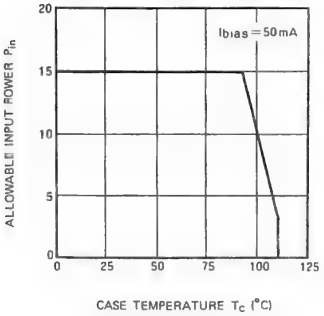




TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated diodes at standard operation

(1) Thermal resistance between junction and package of incorporated diodes.
$R_{th(j-c)} = 70°C/W$ (Typ.)

(2) Junction temperature of incorporated diodes at standard operation. Conditions for standard operation.
$P_{in} = 33W$, $I_{bias} = 50mA$ ($VF = 0.85V$)(1), $r_{fs} = 0.7\Omega$(2), $Z_o = 50\Omega$(3)

Note 1: Forward Voltage of diodes.
Note 2: Series Resistance of diodes.
Note 3: Characteristic Impedance.

- Junction temperature of diodes

$$T_j = [(P_{in}/Z_o) \times r_{fs} + I_{bias} \times VF] \times R_{th(j-c)} + T_c \text{(4)}$$
$$= [(33/50) \times 0.7 + 0.05 \times 0.85] \times 70 + T_c$$
$$= 35.3 + T_c\ (°C)$$

Note 4: Package temperature of device

2. Heat sink design

In thermal design of heat sink, try to keep the package tempeatrure at the upper limit of the operating ambient temperature (normally $T_a = 60°C$) and at the input power of 33W below 90°C.

The thermal resistance $R_{th(c-a)}$(5) of the heat sink to realize this:

$$R_{th(c-a)} = (T_c - T_a)/(P_{in} - P_{out}) = (90-60)/(33-29.4)\text{(6)}$$
$$= 8.3\ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink.
Note 6: Insertion loss is 0.5dB

Mounting the heat sink of the above thermal resistance on the device,
$T_j = 125.3°C$, $T_c = 90°C$
In the annual average of ambient temperature is 30°C,
$T_j = 95.3°C$
As the maximum junction temperature of these incorporated diodes T_{jmax} are 175°C, application under fully derated condition is ensured.

MD004

1200~1300MHz, 5W, ANTENNA SWITCH

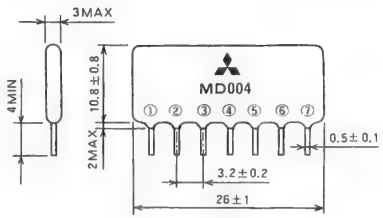
MINIATURE RF ANTENNA SWITCH

MD004 is designed to cover 1200 ~ 1300MHz, 5W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 30dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.8dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output:
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

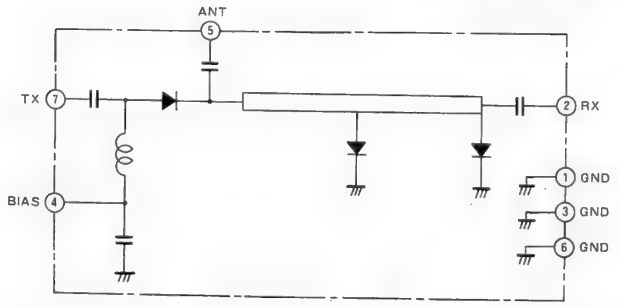
OUTLINE DRAWING

Dimensions in mm



1 GND
2 RX
3 GND
4 BIAS
5 ANT
6 GND
7 TX

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
$I_{bias} = 50\,mA$	ON	OFF
$I_{bias} = 0$	OFF	ON

MITSUBISHI ELECTRIC

1200～1300MHz, 5W, ANTENNA SWITCH

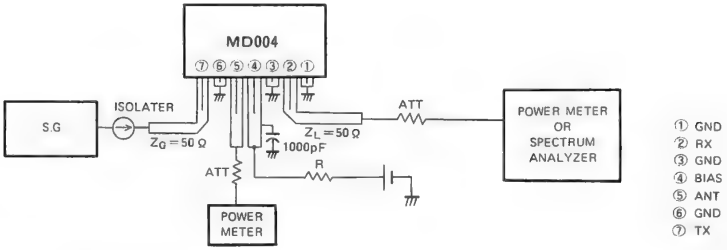
ABSOLUTE MAXIMUM RATINGS (Ta＝25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
I_{bias}	Bias current	100	mA
P_{in}	Input power	10 @ Ta≦60°C	W
Tstg	Storage temperature	−30～+85	°C

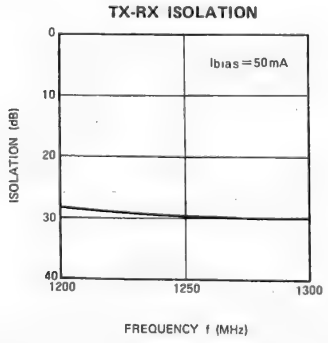
ELECTRICAL CHARACTERISTICS (Ta＝25°C)

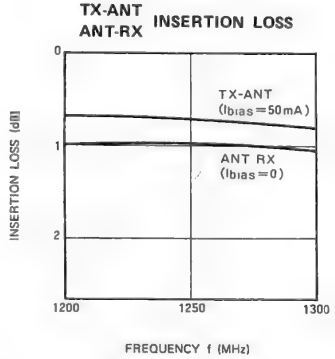
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		1200		1300	MHz
ISO	Isolation (TX-RX)	P_{in}＝8 W, I_{bias}＝50mA, ANT port terminated 50 Ω	25	30		dB
α_1	Insertion loss (TX-ANT)	P_{in}＝8 W, I_{bias}＝50mA, RX port terminated 50 Ω		0.8	1.2	dB
α_2	Insertion loss (ANT-RX)	P_{in}＝1mW, I_{bias}＝0, TX port terminated 50 Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)



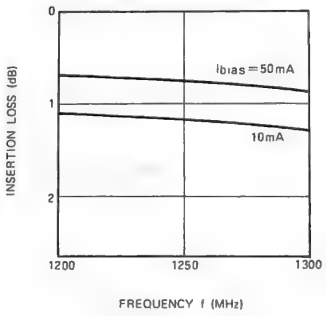
TYPICAL PERFORMANCE DATA



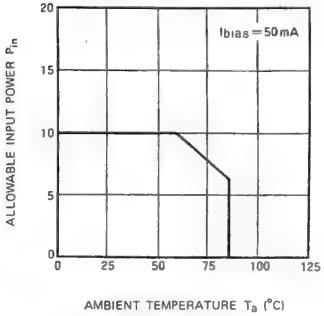


1200~1300MHz, 5W, ANTENNA SWITCH

TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD004.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ①, ③, ⑥ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

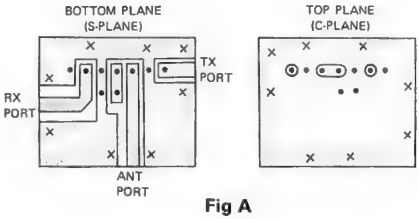


Fig A

MITSUBISHI ELECTRIC

MD004H

1200～1300MHz, 25W, ANTENNA SWITCH

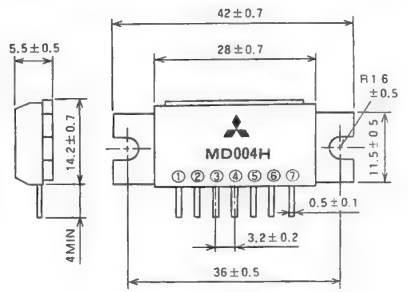
MINIATURE RF ANTENNA SWITCH

MD004H is designed to cover 1200 ～ 1300MHz, 25W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 30dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.8dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output:
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

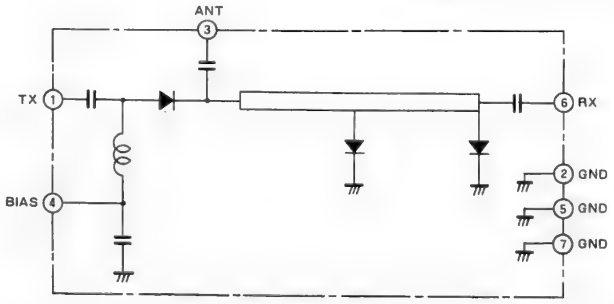
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

1200～1300MHz, 25W, ANTENNA SWITCH

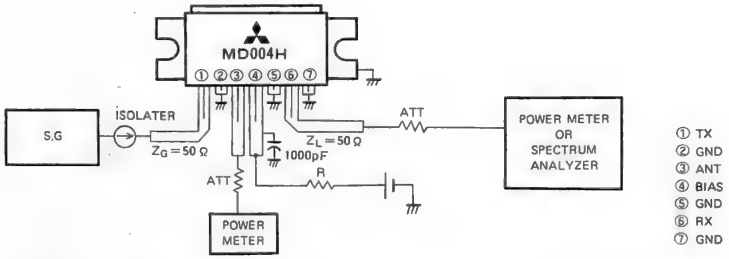
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
P_{in}	Input power	50 @Ta≤90°C	W
Tstg	Storage temperature	−30～+110	°C

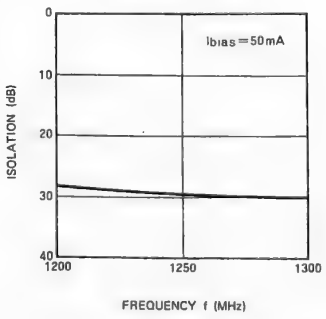
ELECTRICAL CHARACTERISTICS (Ta=25°C)

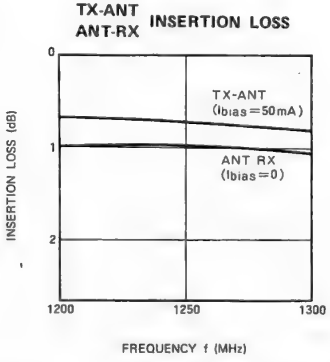
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		1200		1300	MHz
ISO	Isolation (TX-RX)	P_{in}=20W, Ibias=50mA, ANT port terminated 50Ω	25	30		dB
α_1	Insertion loss (TX-ANT)	P_{in}=20W, Ibias=50mA, RX port terminated 50Ω		0.8	1.2	dB
α_2	Insertion loss (ANT-RX)	P_{in}=1mW, Ibias=0, TX port terminated 50Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)



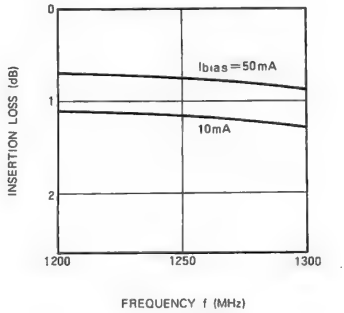
TYPICAL PERFORMANCE DATA



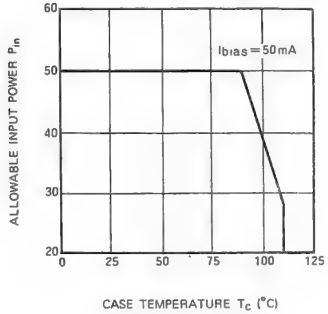


MITSUBISHI ELECTRIC

TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated diodes at standard operation

(1) Thermal resistance between junction and package of incorporated diodes.
$R_{th(j-c)} = 70°C/W$ (Typ.)

(2) Junction temperature of incorporated diodes at standard operation. Conditions for standard operation.
$P_{in} = 33W$, $I_{bias} = 50mA$ ($VF = 0.85V$)(1), $r_{fs} = 0.8\Omega$(2), $Z_o = 50\Omega$(3)

Note 1: Forward Voltage of diodes.
Note 2: Series Resistance of diodes.
Note 3: Characteristic Impedance.

- Junction temperature of diodes

$$T_j = [(P_{in}/Z_o) \times r_{fs} + I_{bias} \times VF] \times R_{th(j-c)} + T_c \text{(4)}$$
$$= [(33/50) \times 0.7 + 0.05 \times 0.85] \times 70 + T_c$$
$$= 40.0 + T_c\ (°C)$$

Note 4: Package temperature of device

2. Heat sink design

In thermal design of heat sink, try to keep the package tempeatrure at the upper limit of the operating ambient temperature (normally $T_a = 60°C$) and at the input power of 33W below 90°C.

The thermal resistance $R_{th(c-a)}$(5) of the heat sink to realize this:

$$R_{th(c-a)} = (T_c - T_a)/(P_{in} - P_{out}) = (90-60)/(33-27.5)\text{(6)}$$
$$= 5.5\ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink.
Note 6: Insertion loss is 0.8dB

Mounting the heat sink of the above thermal resistance on the device,
$T_j = 130°C$, $T_c = 90°C$
In the annual average of ambient temperature is 30°C, $T_j = 100°C$
As the maximum junction temperature of these incorporated diodes T_{jmax} are 175°C, application under fully derated condition is ensured.

MD007L

135～175MHz, 5W, ANTENNA SWITCH

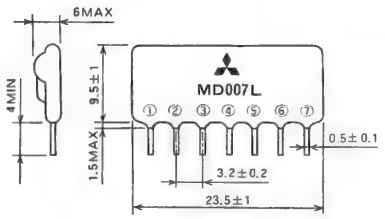
MINIATURE RF ANTENNA SWITCH

MD007L is designed to cover 135～175MHz, 5W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 28dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.4dB Typ.
  ANT-RX 0.5dB Typ.
- Low Harmonic Output:
- Low Operating Current (TX-ANT ON): 20mA
- Off Through (ANT-RX ON): 0mA

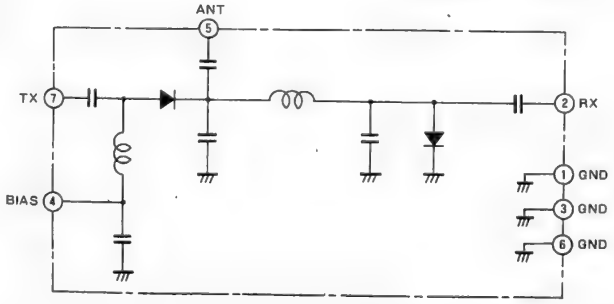
OUTLINE DRAWING

Dimensions in mm



① GND
② RX
③ GND
④ BIAS
⑤ ANT
⑥ GND
⑦ TX

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=20mA	ON	OFF
Ibias=0	OFF	ON

MITSUBISHI ELECTRIC

135～175MHz, 5W, ANTENNA SWITCH

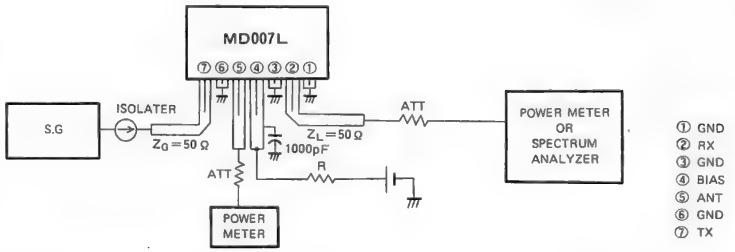
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	10 @Ta≦60°C	W
Tstg	Storage temperature	−30～+85	°C

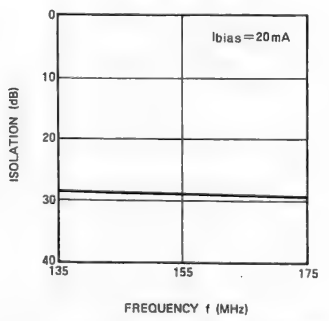
ELECTRICAL CHARACTERISTICS (Ta=25°C)

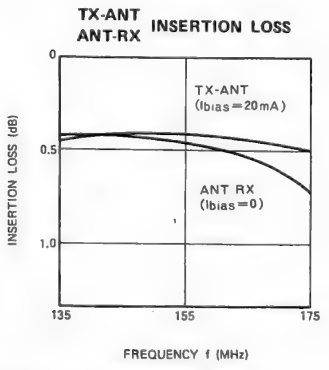
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		135		175	MHz
ISO	Isolation (TX-RX)	Pin= 8 W, Ibias=20mA, ANT port terminated 50 Ω	25	28		dB
α_1	Insertion loss (TX-ANT)	Pin= 8 W, Ibias=20mA, RX port terminated 50 Ω		0.4	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50 Ω		0.5	0.8	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

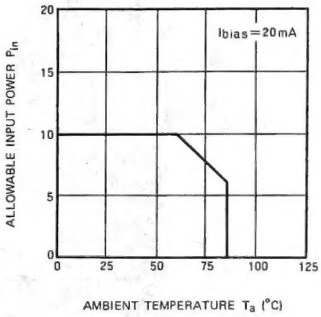


TYPICAL PERFORMANCE DATA





ALLOWABLE INPUT POWER



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD007L.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ①, ③, ⑥ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

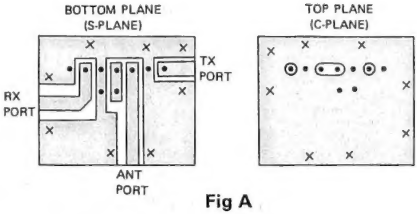


Fig A

MITSUBISHI ELECTRIC

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